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FOCI
Field Manual

March 1999

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FOCI
Field Manual

by

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Introduction

This manual is meant to be a helpful source of information during scheduled Fisheries Oceanography Coordinated Investigations (FOCI) cruises. Since it is not reasonable to expect everyone to remember every aspect of the gear and sampling procedures performed at sea, this manual will serve as a quick reference to answer some of the more common questions which arise. It is also our hope that this manual will help to standardize the way in which samples are taken, labelled, preserved, etc. The FOCI Field Manual is intended to augment the Cruise Instructions. Instructions for special samples or experiments will be provided by the sample requester and the Chief Scientist. This manual has been designed for operations aboard the NOAA ship *Miller Freeman*, and slight modification to some of the procedures may be necessary when using the manual aboard other vessels.

This manual also contains information pertaining to the discrete sample database (DSDB) and tips on how to code certain sampling scenarios. It is important that the DSDB sheets are properly and completely filled out and entered into the application. While at-sea, this data is used to map cruise stations, check station locations, calculate and map standardized rough count catch information, and create cruise reports. At the laboratory, this data is used to check and complete sample shipping inventories, fill tables in the Polish data entry application, and complete tables in the FOCI ichthyoplankton database.

Acronyms Used In This Manual

ADCP
Acoustic Doppler Current Profiler

BKG
Bathykymograph

CalCOFI
California Cooperative Oceanic Fisheries Investigations

CTD
Conductivity Temperature Depth

DSDB
Discrete Sample Database

EBKG
Electronic Bathykymograph

FOCI
Fisheries Oceanography Coordinated Investigations

FOO
Field Operations Officer

GMT
Greenwich Mean Time

HMIG
Hazardous Materials Identification Guide

MOCNESS
Multiple Opening and Closing Net and Environmental Sensing System

MSDS
Material Safety Data Sheets

NOAA
National Oceanic and Atmospheric Administration

PMEL
Pacific Marine Environmental Laboratory

RACE
Resource Assessment and Conservation Engineering

SCS
Shipboard Computer System

XBT
Expendable Bathythermograph

Table of Contents

List of Contents (by Section and Discrete Sample Database code)

Section: GEAR

NET TOWS

NET ELECTRONICS

CTD/Rosette

TRAWLS

NON-ELECTRONIC INSTRUMENTS
BKG.....manual bathykymograph
FLOWMETER.....flowmeter

OTHER
ASOUND.....atmospheric weather balloons
BIOOTHER.....biological gear not covered by any specific gear abbreviation
MOOR.....oceanographic mooring at a fixed location
PHYOTHER.....physical gear not covered by any specific gear abbreviation
SATBOUY.....satellite tracked drifter deployment
SEDTRAP.....sediment trap
SHIPBOUY.....RADAR tracked drifter
TRANS.....dedicated transect
XBT.....expendable bathythermograph

Section: SAMPLING

EGGS
PRED..... predator collections (of walleye pollock eggs)
QTOWF..... quantitative tows preserved in formalin
QTOWS..... quantitative tows preserved in Stockards solution
RCOUNTE..... rough count to estimate egg abundance

LARVAL
BRAIN..... brain tissue from larvae
L-BIOCH..... larvae for biochemistry
L-GUT..... larval gut samples
L-HIST..... larval histology
L-MUSC..... larval muscle DNA
L-OTO..... larval otoliths
MERIST..... meristic studies
PRED..... predator collections
QTOWF..... quantitative tows preserved in formalin
RCOUNTL..... rough estimate of larval abundance
SHRINK..... shrinkage experiments

JUVENILE (AGE-0)
J-GENET..... juveniles collected for genetic studies
J-GUT..... juvenile stomachs for gut analysis
J-LENGTH..... juvenile length measurements
J-OTO..... juvenile otolith collections
J-WGHT..... juvenile weight measurements
MERIST..... meristic studies
QTOWF..... quantitative tows preserved in formalin
ROUGH COUNT.. rough estimate of juvenile abundance

ADULT

A-GENET..... adult genetic tissue
A-GUT..... adult stomachs for gut analysis
A-LENGTH..... adult length measurements
A-OTO..... adult otolith collections
A-WGHT..... adult weight measurements
BLOOD..... adult blood collections
OVARY..... adult ovary collections
STRIP..... strip spawning

NET ELECTRONICS

CAT..... SEACAT CTD data collection
EBKG..... electronic bathykymograph data collection
NETFLOUR..... fluorometer attached to net tow
SCANMAR..... SCANMAR data collection
VIDEONET..... video camera attached to net tow

CTD/ROSETTE

ABSORB..... spectral absorbance samples
BKG-CAL..... calibration of manual bathykymograph
CHLAM..... chlorophyll absorption meter mounted on CTD
CHLOR..... chlorophyll samples
CTD..... CTD data collected
FLOUR..... fluorometer data collected
LUGOLS..... Lugol's preserved samples collected
MZ..... microzooplankton samples collected
NUT..... nutrient samples collected
PAR..... light meter data collected
PHYTOF..... phytoplankton samples preserved in formalin
POC..... particulate organic carbon samples
VIDEOCTD..... video camera attached to CTD

DEDICATED TRANSECTS

ADCP..... ADCP data collection
EK500..... EK500 data collection
SSF..... sea surface flourescence data collection
TSG..... thermosalinograph data collection

OTHER

ALGAE/JELLY PROBLEMS..... instructions for heavy algae/jelly tows
ASOUND..... atmospheric weather balloons
BIO-OTHER..... biological samples specially requested and have no assigned DSDB code
DEPLOY..... deployment of bouy or mooring
DISCARD..... discard of sample due to gear or sampling failure
LIVE..... live collections of organisms for at-sea experiments
PHYOTHER..... physical samples specially requested and have no assigned DSDB code
RECOVERY..... recovery of bouy or mooring
SURFACE CHLOROPHYLL..... surface chlorophyll samples
XBT..... expendable bathythermograph

Section: DSDB

Introduction
Station/Haul Information
Gear Information
Purpose
Performance
Gear Types
Samples Collected
The Application

Section: CHEMICALS

Aboard Ship
Chemicals Aboard Vessels-Chief Scientist Guidelines
Directions For Making Sodium Borate Solution
Preservation Instructions
Standard Operating Procedures...95% Ethanol
Standard Operating Procedures...37% Formaldehyde
Standard Operating Procedures...10% Formalin
Standard Operating Procedures...5% Formalin
Vessel Chemical Inventory Form...NOAA Vessels

Section: MICROSCOPES

Instructions For Setting Up Microscopes
Conversion Charts

Zeiss Stemi-2000: from micrometer units to mm
Zeiss Stemi-2000C: from micrometer units to mm

Section: FORMS and LABELS

Age-0 Length Form
CTD Cast Chlorophyll Sampling Log
CTD Cast Log Form
Discrete Sample Database Entry Form
Flow-Thru Chlorophyll Sampling Log
Haul-Position Form
Label Examples...specimen, inside jar, FOCI
Length-Frequency Form
MOCNESS DSDB Entry Form
On-Deck Sampling Form - Species Composition
Sample Request Form
Specimen Form

Section: MISCELLANEOUS

Common Formulas
Embryonic Development
Green Larval Notebook...example pages
Larval and Juvenile Fish Indentification
Measurement Conversions
On-Deck Sampling Information Chart
Use of -80°C Freezer
Wire Out/Desired Net Depth Chart

Section: GEAR
List of Contents (by Discrete Sample Database code)

NET TOWS
20BON.....20 cm bongo
60BON.....60 cm bongo
CALVET.....CalCOFI vertical egg tow net
IKMT.....Issacs-Kidd midwater trawl
IKS.....Soviet vertical ring net
LG-CB.....10" ID modified Clarke-Bumpus
LIVE..... live vertical tow from a 60 cm bongo/taped codends
METH.....Methot trawl
MOC1.....1m^2 MOCNESS
MOC2.....2m^2 MOCNESS
NEU.....neuston
RING.8.....live zooplankton .75 m ring net
RING1.....1 meter ring net
SLED.....epibenthic sled
SM-CB.....5" ID Clarke-Bumpus
TUCK1.....1 meter Tucker trawl

NET ELECTRONICS
CAT.....SEACAT CTD
EBKG.....electronic bathykymograph
NETFLUOR.....fluorometer attached to net
SCANMAR.....SCANMAR
VIDEONET.....video camera attached to net

CTD/Rosette
BOTTLES.....Niskin bottles without CTD
CTD.....CTD cast
CTDB.....CTD cast with samples collected from Niskin bottles
VIDEOCTD.....video camera attached to CTD

TRAWLS
ANCHO.....anchovy trawl
DIAM.....diamond trawl
EASTERN.....eastern or 83-112 trawl
MARIN.....Marinovich trawl
NOR.....Nor'eastern bottom trawl
ROPE.....rope trawl
SHRIMP.....shrimp trawl

NON-ELECTRONIC INSTRUMENTS

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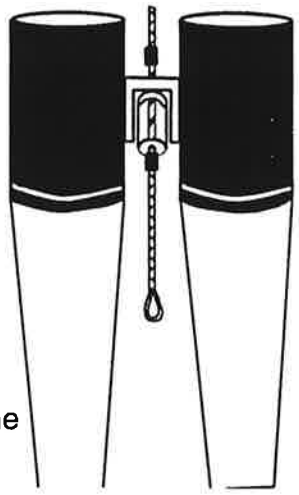
20BON (20 cm Bongo)



The 20 cm Bongo with 150 um mesh is used to collect zooplankton in conjunction with the 333 um meshed 60 cm bongo.

Assembly

Assembly requires the attachment of the nets, and mounting of the flowmeters. Nets are attached using a stainless steel hose clamp to secure the nets on the frame. Make sure some of the heavy nylon material extends over the end of the frame to help protect the fine mesh of the nets when setting the frame on deck.

Rates/Fishing

The 20 cm array is placed about 1 meter above the 60 cm bongo frame using the special cable provided that has stops (nicopress sleeves) to attach the 20 cm frame. Grasp the 20 cm frame with the net numbers on the frame facing up. With the nets of the 20 cm bongo straddling the towing cable, turn the top of the brass swivel in the middle of the frame so the cable (between the two stops) can be placed in the groove. Turn the top of the swivel back, and secure with the cotter pin found at the top of the swivel.

It is helpful when the nets are going over the side for someone to hold the 20 cm codends up above the 60 cm frame to avoid tangling (also watch that the Seacat does not hit the inclinometer). Watch as the nets are on the surface and starting down to make sure that all the nets are alright.

Rates (same as 60 cm Bongo)
- Ship speed 1.5 - 2.0 knots to achieve 45 degree towing angle.
- 50 m/min wire out speed, winch and weather permitting.
- 20 m/min wire in speed.

The 20 cm/60 cm bongo array will be monitored from Dataplot and commands given to the winch operator to stop and/or retrieve the tow. Unless specified otherwise, these tows will be fished to within 5 - 10 meters of the bottom, and will have 153 um mesh.

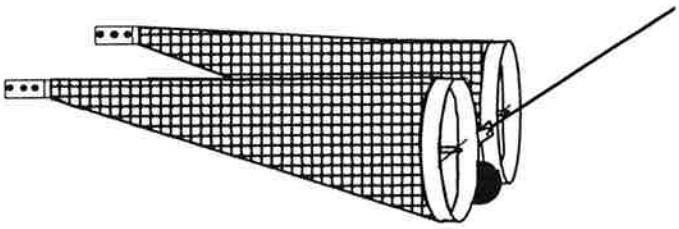
Preservation

Preservation will depend on cruise requirements, but will usually be QTOWF

Maintenance

Check nets for holes and fill flowmeters with water as needed.

60BON (60 cm Bongo)



The 60 cm bongo is used for standard double oblique MARMAP tows. A Seacat or electronic BKG should be attached to the wire above the bongo frame to provide real-time tow data. The depth of the nets are monitored from DataPlot and commands given to stop the winch and begin retrieval. When the nets surface, they are brought aboard and hosed down to wash the sample into the codend. Flowmeters in the nets record the amount of water filtered and the Seacat or BKG records the depth profile of the tow. Tows not meeting specifications may be repeated at the discretion of the scientific watch. The scientists are responsible for recording times and maximum depths in the Seacat log book.

On selected tows (FOX time series (e.g. Line 8), and certain patch or transect studies) a 20 cm bongo frame with two 153 um mesh nets will be attached 1 meter above the 60 cm bongo frame using the special cable provided that has stops to attach the 20 cm bongo frame (see **20BON**).

Assembly

Attachment of the nets requires sliding the open end of the net over the frame and securing with a stainless steel clamp. The lead ball is shackled to the center pivot on the frame. A Survey Tech will be responsible for mounting the Seacat (or EBKG), and will require about a 1/2 hour to complete connections. A flowmeter is mounted in the center of the each mouth opening using heavy monofilament, nico-press sleeves, and attached to eyebolts on the frame.

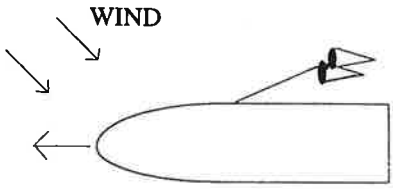
Prepare for the tow while the ship is approaching the station. Make sure the proper codend (or sock) is attached to the proper net, check the flowmeters, prepare field logs (DSDB), jars, and jar labels.

Rates/Fishing

- 50 m/min wire out speed (if winch speed permits, but at least 40 m/min). During periods of bad weather and heavy surge, instruct the winch operator to start wire out at a slower rate (20 - 30 m/min) to prevent backlash on the winch, speeding up as conditions permit.
- 20 m/min wire in speed.

60Bon (cont'd)

- The ship speed (1.5 - 2.0 knots) is adjusted to maintain a 45 degree wire angle. There should be an angle indicator (inclinometer) mounted on the towing cable monitored by the Survey Tech who reads wire angles to the Bridge. The Bridge (on the Miller Freeman) should have a readout to assist in maintaining the 45 degree wire angle. If there is no inclinometer on the cable, use a hand held inclinometer.
- Perform tows in a single direction as shown. This position, relative to the wind, helps insure against the net and cable being run over by the ship.



Preservation

Preservation of samples will depend on cruise requirements. Usually, one or both nets will be a QTowF, and possibly a QTowS, RCount, or Discard. The cruise instructions and/or the Chief Scientist should have specific information for each net and sample type. For QtowF, place codend in bucket and immediately take into laboratory for processing. Gently wash contents into a Tyler sieve (**make sure mesh size of sieve is not larger than mesh of codend**) and then wash material into a funnel placed in the mouth of a 32 oz. jar. Leave room in the jar to add 50 ml of formaldehyde and 25 ml sodium borate buffer, and fill the rest of the jar with seawater.

Maintenance

The only maintenance needed is to check nets for holes or rips and repair or replace as necessary. Check flowmeter counts after each tow, and periodically check to make sure they are filled with water. Immediately replace any suspect flowmeters.

Sampling Protocol Guideline

Determining which mesh to use and depth to fish is decided by the time of the year, size of eggs/larvae, plankton required, and bottom depth. This table is meant to be a guideline but the Chief Scientist or Principal Investigator should inform shipboard personnel to specific requirements as to net mesh size and sample processing.

	Net 1		Net 2		Sample Depth
Pollock Eggs	505 um	QTowF	505 um	RCount Discard	5 - 10 m within bottom (400 m max.)
Larvae < 6 mm	333 um	QTowF	Varies		5 - 10 m within bottom (400 m max.)
Larvae ≥ 6 mm	505 um	QTowF	Varies		100 m (or 5 - 10 within bottom if shallow)
FOX Sta, Zooplankton studies (with 20 cm Bongo)	505 um or 333 um (same as 'Grid')	QTowF	333 um Never 505 um for Zoops	QTowF	5 - 10 m within bottom

Info. provided by: J. Clark

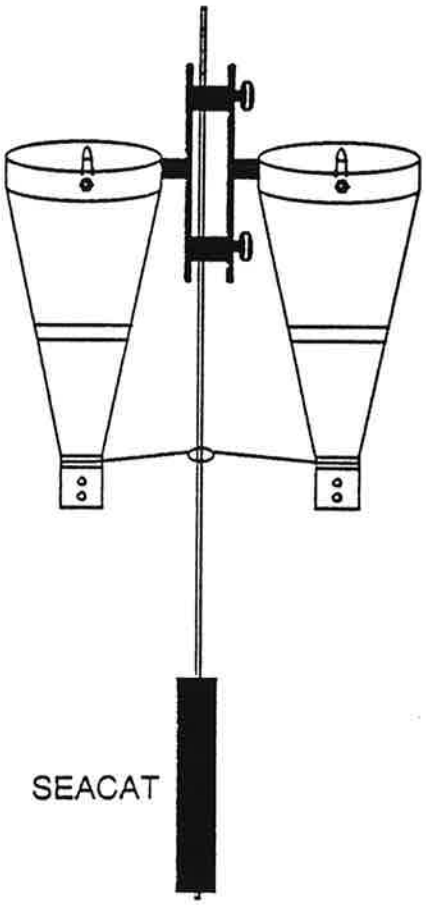
9-Nov-98

CALVET (CalCOFI Vertical Egg Tow Net)

FOCI generally uses the CALVET net to sample microzooplankton in the water column using 53 um mesh. They have also been used in the past to sample pollock eggs.

Assembly

Attach nets to frame using the hose clamps on frame. The top side of the hoop has a solid continuous bead of material around it. Secure frame to winch cable by tightening the knobs on the frame. Codends should be secured to wire by tying a piece of parachute chord around collars of each net and attaching to a clamp on the winch cable (stretch nets taut). Flowmeters should be attached inside each side of the frame.
Note: There are two mesh sizes, 53 um used for microzooplankton collection and 500 um used for pollock egg collection.



The SEACAT should be mounted at a maximum of 2 to 3 meters below the CALVET. To ensure that the CALVET is fishing from 0 to 60 meters, drop the gear in the water and stop when the mouth of the CALVET is just below the surface. Have the person monitoring the SEACAT data note the depth reading of the SEACAT and have the winch operator zero the wire out display. Have the person monitoring theSEACAT stop the winch at a depth 2 to 3 meters more than 60 meters.

CALVET (cont'd)

Rates/Fishing
Standard tow depth for microzooplankton collection is 60 meters. The CALVET depth should be monitored by the SEACAT (see above) and files should be saved unless otherwise specified. The net should be lowered and retrieved at a rate of 45 - 60 m/min depending on winch capabilities. The tow should be vertical with ship maneuvering only to maintain zero wire angle. Record tow time on ascent only since the net is designed to flush on descent. Net contents should be washed into codends being careful not to introduce contamination from the deck hose. Do not squirt hose into mouth of the net, wash through the sides.

Special requests for tows to near bottom are not uncommon. If using 53 um mesh, then the wash down procedure will be the same as above.

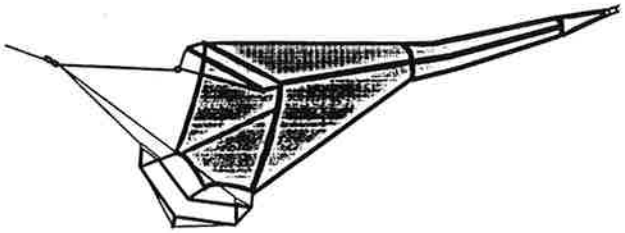
Labelling
Please use two identical self adhesive FOCI labels on jars. **PLEASE DO NOT USE MICROZOOPLANKTON LABELS BECAUSE ADDITIONAL INFORMATION ON MICROZOOPLANKTON LABELS IS NOT INTENDED FOR CALVET AND WILL ONLY CONFUSE THE SORTERS.** NO INSIDE LABELS PLEASE.

Preservation
Samples are preserved using filtered sea water (at least down to 53 um) and 50 ml of buffered formaldehyde in 32 oz jars. Check with cruise instructions/Chief Scientist to see if both sides of the net need to be preserved.

Record Keeping
Record tow time on ascent only since the net is designed to flush on descent.

IKMT (Isaacs-Kidd Midwater Trawl)

The Isaacs-Kidd Midwater Trawl collects bathypelagic biological specimens larger and more active than those taken by standard plankton nets. The trawl consists of a net of special design attached to a wide, v-shaped, rigid diving vane. The vane keeps the mouth of the net open and exerts a depressing force, maintaining the trawl at depth for extended periods at speeds up to five knots.



Assembly

The following items are required to assemble the net:

1) net
2) bridle
3) depressor vane, with hinged side arms
4) spreader bar (iron pipe to aid in keeping net open)
5) codend
6) flowmeter

Using shackles, attach the depressor and spreader bar to the net and then the bridle (see the diagram on the following page). Attach a codend of desired mesh and place a flowmeter across the mouth opening using heavy monofilament and nicopress sleeves.

Rates/Fishing

The IKMT is deployed off of the stern (Miller Freeman). The use of SCANMAR to provide depth is desired. Here are some general guidelines for towing, but the Chief Scientist should have exact rates and speeds:

- ship's speed 3 to 4 knots (can be as high as 6 knots)
- wire out speed 50 m/min
- wire in speed 20-30 m/min
- wire angle estimated to be about 65 degrees

Have the ship slow down to about 2 knots when the net is 10 meters from surface or in sight to aid in retrieval.

Preservation

Preservation will depend on cruise requirements, but will usually be QTOWF.

Maintenance

Check the net for holes and periodically check the flowmeters for water and reasonable revolutions.

IKMT (cont'd)

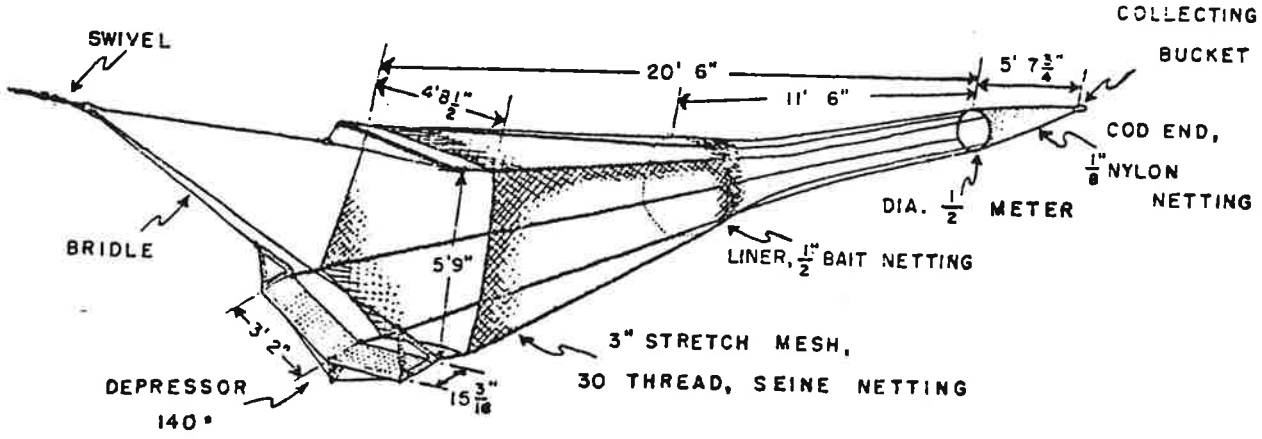


Photo Credit: Isaacs, J. D., L. W. Kidd. 1953. Isaacs-Kidd midwater trawl. Scripps Inst. Oceanogr., Ref. 53-3, 21p.

Info. provided by: J. Clark

9-Nov-98

IKS (Soviet Vertical Ring Net)

The IKS is a Soviet ring net that has been used in place of the bongo net.

LG-CB (10" ID modified Large Clarke-Bumpus)

FOCI uses a modified 10" Clarke-Bumpus net inside a Tucker trawl net to collect quantitative samples during predator collections.

Assembly/Preparation

Two LG-CB nets are attached to the inside of net 1 and 2 of the Tucker trawl (see illustrations on page 2). The tether cord lines on the frame are attached with the snap-rings to the brass rings sewn in the inside of the Tucker nets. A flowmeter is placed in the center of the Clarke-Bumpus net. The flow counts from a tow will be used for both the LG-CB and Tucker net. Mesh size will vary depending on sampling request. Be sure to mark the nets with same numbers as the Tucker net they are inside of. It is also possible to suspend a LG-CB net inside the Methot. Instructions regarding assembly will be given with any requests.

Fishing / Rates

If used inside Tucker trawl, then rates will be same as Tucker.

Preservation

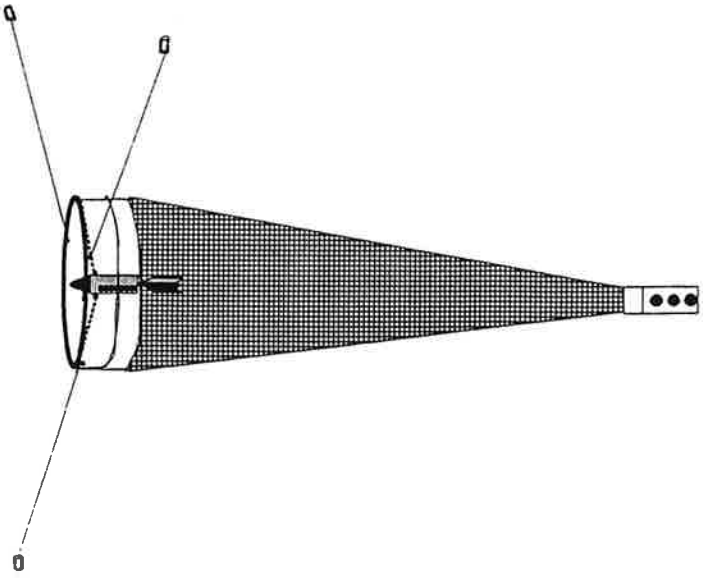
Codend should be brought into Wet Lab for processing. Preservation will vary depending on sample request.

Maintenance

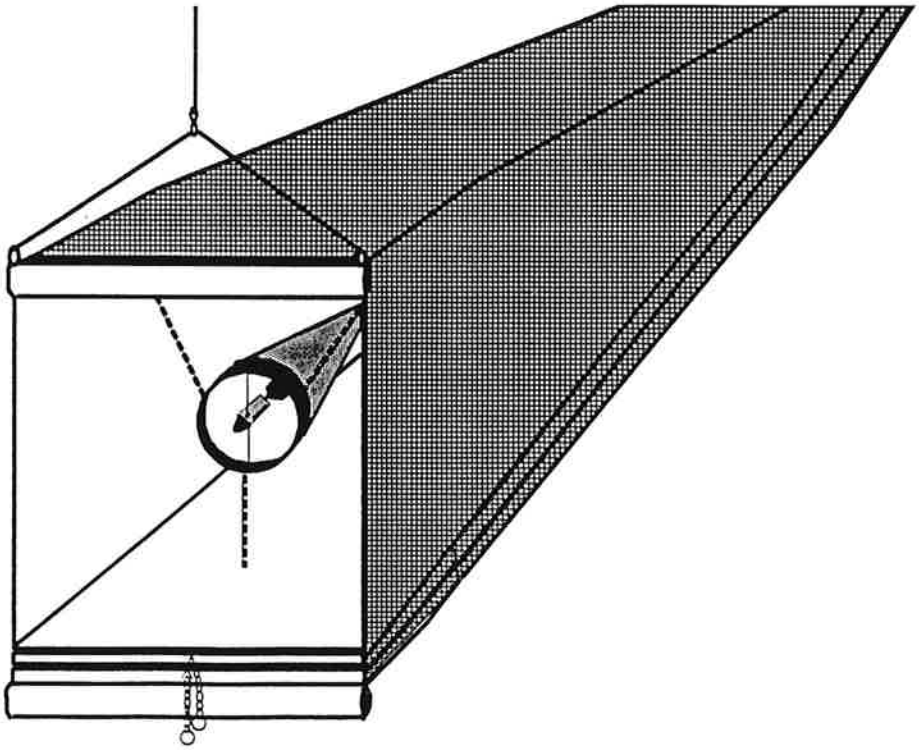
Rinse and dry the nets before storage. Remove the flowmeter and store in the flowmeter box.

LG-CB (cont'd)

Large Clarke-Bumpus Net



Profile



Inside Tucker Trawl (Net 2)

LIVE (Live Vertical Tow From 60 cm Bongo / Taped Codends)

Live larval pollock obtained for use in various analyses such as L-Musc, histology, etc.

Preparation

Locate the following equipment:

larval forceps
pipets (glass or plastic)
white bowls or pans for sorting
ice-bed to put under sorting bowl/pan
chilled and filtered seawater
scintillation vials
labels (for outside of vials only)
alcohol proof pen
1.5 ml microcentifuge tubes
freezer boxes and blue freezer block
microscope slides
divided petri dishes

Collection

A live tow for larval pollock uses the 60 cm Bongo with 333 um or 505 um net mesh with taped codends. The selection of mesh size will depend on the time of field collections, larval size, amount of algae, etc. This is meant to be a vertical tow with ship speed used only to maintain a zero wire angle. **Make sure the SEACAT is on and the data saved for each haul.** The wire out rate is 45 m/min with the maximum gear depth to 70 meters wire out (if bottom depth is deep). If the larvae come up dead (sometimes happens due to weather and difficulty of maintaining a zero wire angle), then try gear depth to 40 - 50 meters. The wire in speed should be 10 m/min. Begin timing the tow when the net is starting up. Observe time restrictions, if specified, for each sample type. The time limit is usually 12 minutes total for net retrieval and preservation. Do not rinse down the nets when they return to the deck. Open the codends immediately into clean (live) 5 gallon buckets. Carefully pour the codend contents into a sorting bowl or pan (an ice bed is not needed) and sort for larval pollock quickly to accommodate time restrictions using either a pipet or forceps.

Preservation

Sort larvae directly into specified preservative if possible. Remember that preservation of live larvae (wigglers) is best so that a time restriction or tissue degradation is not a problem.

Record Keeping

Be sure to keep the Green Larval Notebook updated with specimen numbers. It is also important to save the SEACAT file for each live tow since this will be our only chance to obtain in situ data for the larvae.

LIVE (cont'd)

Miscellaneous

Please remember to rinse the nets and codends thoroughly and record the new initial flowmeter revolutions before starting a quantitative tow (standard 60 cm Bongo).

METH (Methot Trawl)

The Methot trawl is used for the collection of juvenile fish and/or plankton samples.

Description/Assembly

The Methot trawl is a 5.168 m^2 fixed frame net with 3 x 2 oval mm mesh in the body and a 1.0 mm mesh in the hard codend. A 6-ft IKMT depressor is attached at the lower corners of the frame to provide increased depth with wire out (see Fig. 1). The depressor is modified by having the hinged side arms removed and attachment points drilled into, or welded onto, the depressor near the hinges. A General Oceanics flowmeter should be suspended off center of the mouth of the trawl and readings should be taken before and after the tow. The Scanmar depth sensor should be attached on top of the frame and aimed forward in the direction of the ship.

Rates/Fishing

The Methot trawl is deployed using the Rowe or Marco winch off the stern of the vessel (without the stern platform). A Scanmar acoustical depth sensor (with a readout in dataplot and using a hydrophone suspended from the port quarterdeck boom) should be used to receive real-time depth information. A scientist or survey tech in dataplot will relay orders for stopping and starting the winch to the winch operator based on trawl depth. However, it is usually possible to use the Scanmar unit in the Trawl House utilizing a hull-mounted transducer if it is set up during the cruise.

The trawl will be deployed at 40 m/min (30 m/min if rough seas) and retrieved at 20 m/min. Tows are generally oblique or stepped oblique from near bottom or the desired depth to the surface, although depending on the study, particular depth layers may be targetted. Ship speed should be from 2 - 3 knots. Methot trawls will be conducted in daytime or at night with little or no advanced warning. As for where and when they will be done sometimes depends on acoustic signals. However, the fishing crew is not needed to deploy this gear under normal conditions. **It is important to not exceed tow speeds of 3.5 knots (bending of frame may result).**

Processing/Preservation

Once aboard, the net should be quickly washed down and the contents of the codend transferred to a bucket. A large white pvc sieve (1 mm) is provided to remove excess water. All large medusae should be removed prior to preservation (rinse off medusae with seawater and make sure anything stuck to them is preserved with the rest of codend contents). In most cases, the entire sample should be preserved in buffered 95% ethanol or 5% formalin (depending on sample request) in several 32 oz jars, although some fish or invertebrates may be removed for special studies. Occasionally, the sample is too large to easily fit in jars so it may be split at sea or else the fish may be removed and the rest of the sample discarded if there is no interest in the invertebrate catch. See section on **Catch Processing** for more details.

METH (cont'd)

Record Keeping

Use the On-Deck Sampling Form to record species, weights, and count numbers. Always record numbers and/or weights (by taxonomic group) of the discarded portion of the catch. A Haul Position Form may be requested from the Bridge if the watch chief so desires. A Length Frequency Form may be required for recording freshly measured lengths (usually standard length in mm). If it was necessary to discard any portion of the catch, then make a note in Comments section of DSDB on how many (and/or weights) were discarded of each taxonomic group.

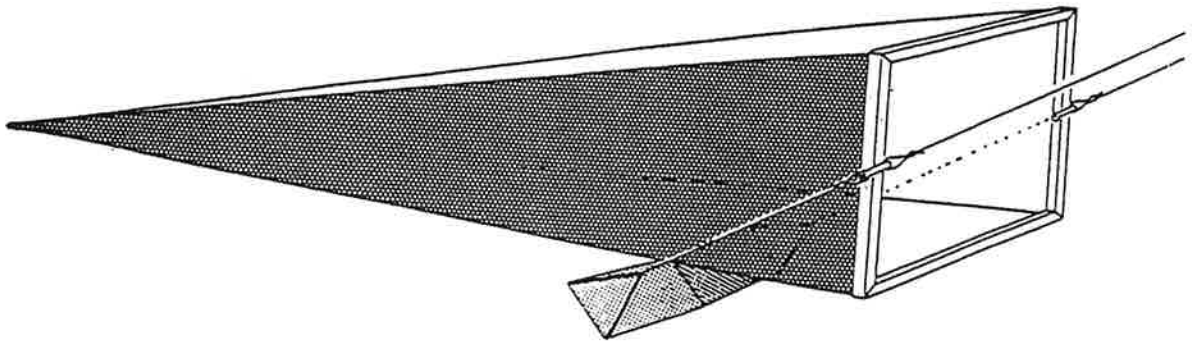


Figure 1. Methot frame trawl with the Isaacs-Kidd depressor (Methot 1986).

METH (cont'd)

Catch Processing

The sample collected will be sent to Poland for sorting. In order to get it into a reasonable number of jars, satisfy special requests, and to maintain consistency, please use the following procedures when processing a Methot haul.

** Remove all large jellyfish (>30 mm diameter) from the catch. Rinse each jelly to remove all attached organisms (use a 5 gal. bucket half filled with water). In case of tentacle entanglement, rinse the jelly as best as you can so that all fish and as many invertebrates as possible are removed. Weigh and count the jellies as a group. Since jellies often break apart, it may be difficult to get individual numbers. These bits and pieces should be included with the group weight but should not be counted unless the pieces obviously represent another whole individual.

**All remaining fish and invertebrates should be preserved with 5% formalin in 32 oz. jars. First count and weigh all age - 0 gadids (small pollock and cod are difficult to separate). If the amount to be preserved is more than what can be reasonably preserved in 4 jars, then you will have to choose to either save it all or sub-sample by weight.

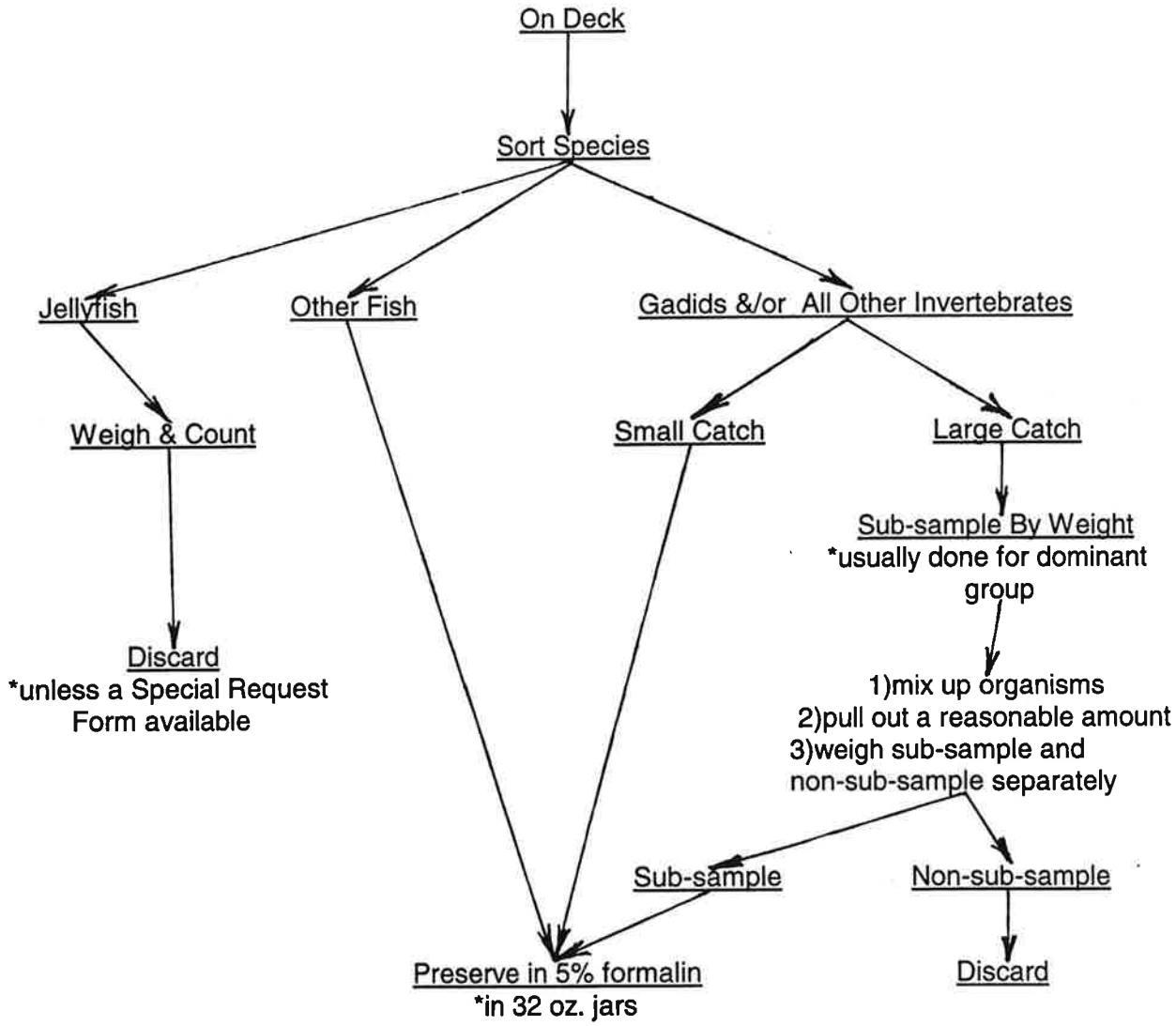
**Sub-sampling by weight is necessary when a sample is comprised of a large amount of invertebrates (usually euphausiids are the primary taxa with some copepods, molluscs, amphipods, etc.) or pollock. Sort out the group of organisms that will have to be sub-sampled. Do not bother separating the invertebrate groups, just lump it all together and call it an invertebrate mix (make sure that no fish are included). Mix the organisms as best as you can so that a sub-sample will be representative of the whole (usually this is done in a container with all of the excess water poured off). Remove enough organisms to fill 2 - 4 jars. Weigh the sub-sample to the nearest gram and then weigh the non-sub-sample as well. Record these weights on the On-Deck Sampling Form specifying the units (kg or g). Also remember to record that the sub-sample+discard weights = the total weight.

** For pollock, or some other specifically identified fish taxa, follow the same sub-sampling steps for invertebrates and weigh. Count the number of fish in the sub-sample and if time permits, count the number discarded.

References:
Methot, R. D. 1986. Frame trawl for sampling pelagic juvenile fish. Calif. Coop. Oceanic Fish. Invest. Rep. 27:267-278.

METH (cont'd)

Catch Processing Chart



MOC1 (1 m² MOCNESS)

The 1 m² Multiple Opening/Closing Net Environmental Sampling System allows the opportunity to quantitatively sample selected depth strata.

The MOCNESS is an intricate piece of equipment. A trained scientist will always be on a cruise when the gear is being fished. Information provided here is mainly for watch standers.

Preparation

Put on codends and secure fasteners with duct tape. Match codends to collars by number. Jar labels need to be prepared. Check with scientist in data plot to make sure net numbers on 32 oz jars match those in recorded files.

Two people will be needed to hold tag lines when launching and recovering MOCNESS and to help rinse nets once the MOCNESS is back on deck.

Labelling

Use the water proof inside jar labels for the inside of jars. For outside labelling use the self adhesive FOCI labels. If samples are large (plankton occupies more than 1/2 of the volume), use an appropriate number of 32 oz jars being sure to write *# of total* on inside and outside labels.

Preservation

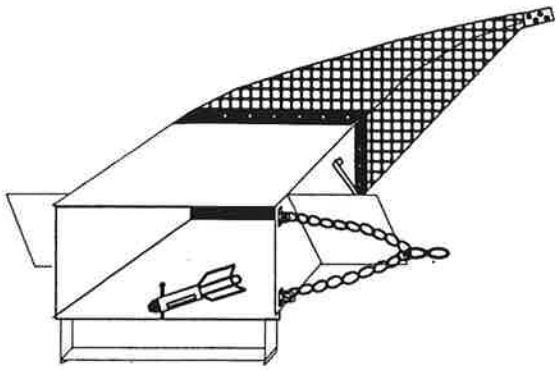
Samples are usually preserved as QTOWF.

MOC2 (2 m² MOCNESS)

Instructions regarding operation of the 2 m² MOCNESS will be provided when necessary.

NEU (Neuston)

Neuston nets are used for sampling the upper few centimeters of the water column. There are many frame styles that may be used (we use a Sameoto sampler made of stainless steel). The mouth opening is 30 cm x 50 cm and is designed to fish half in and half out of the water.



Sameoto Neuston Sampler

Assembly

If the frame is not already put together, some assembly will be required. There are two wings that need to be matched up to the holes on the frame and bolted on. Then bolt on the struts that reinforce the wings. There are a series of holes on the aft end of the frame that the net attaches to with metal straps and bolts. If the net does not already have holes, make them. Slide the net over the frame in the position to be used and use a marking pen to indicate where holes are to be made. Remove and cut holes using scissors, re-attach the net, and secure with the metal straps and bolts.

The Sameoto is designed to be towed from the side to provide an unobstructed mouth opening. Make sure the towing chain (bridle) is connected to the proper side of the frame, depending on which side of the ship you are sampling from (the frame in the picture above is set up to fish from the starboard). Some re-positioning of the swivel on the tow chain may be required to provide a proper attitude of the frame, ideally it should fish half in and half out of the water.

The flowmeter is attached with a special bolt to the bottom of the frame, just back from the mouth opening. Remove the lanyard pin from behind the nosecone of the flowmeter by unscrewing the nosecone and backing off the screw that is holding the pin in place. Place flowmeter on pin, making sure the window for reading the revolutions is facing up, and attach.

Rates/Fishing

The vessel should be moving slowly, about 1.5 to 2.0 knots (the exact speed is a learning process and may vary with sea conditions) so that the net is fishing half in and half out of the water. Lower the neuston net to the surface and pay out 10 - 15 meters of wire. It may be necessary to adjust the ship's speed to maintain the proper skimming action. Start the stopwatch when the net starts to fish and tow the net for ten minutes (unless instructed otherwise). Advise winch operator when time is nearly up and retrieve when ready. Read and record flowmeter revs, time of tow, and any comments.

NEU (cont'd)

Note It may prove helpful (and safer) to attach a long rope tagline to the frame to assist in getting the frame on board. In heavy winds, the sampler tends to act as a kite.

Preservation

The neuston sample should be preserved as a QTOWF unless stated differently in a special request.

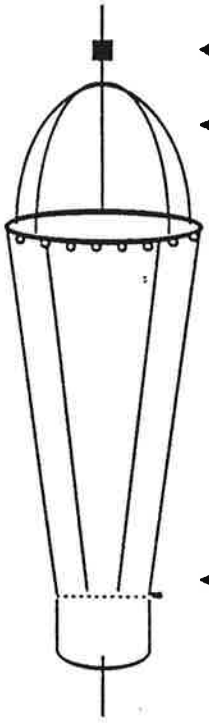
Maintenance

Check net for holes and fill flowmeter with water.

RING.8 (Live Zooplankton Net)

This is a 0.75 m ring net with a large clear polycarbonate codend used to collect live organisms for at sea experiments.

Assembly



← clamp

← Secure bridle to the net and winch cable.

← Secure net to the SS ring using parachute cord.

Net is white with red and blue stripes.
Mesh size is 202 um.

← The hard plastic codend is zipped inside the soft codend carrier.

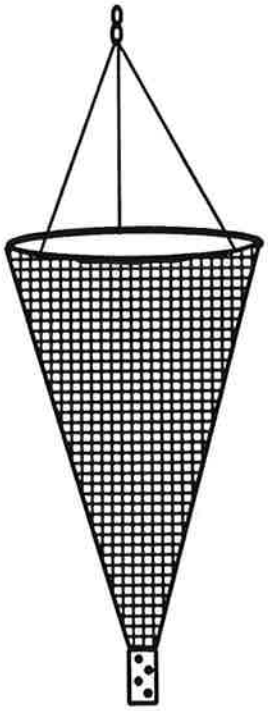
Rates/Fishing

This should be a vertical tow with ship maneuvering only to maintain a zero wire angle. The net goes down at 45 - 60 m/min (depending on winch capabilities) and up at a rate of 10 m/min. Depth of tows will be determined by the SEACAT and files will be saved by request. A flowmeter is not required.

Do not rinse net prior to codend removal. Pour codend contents into a clean live bucket that is chilled by a surrounding icebed (a plastic tub with ice) until sorting can be completed.

RING1 (1 meter Ring Net)

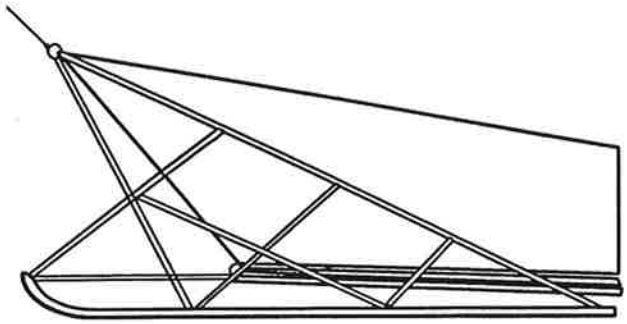
The 1 meter ring net is normally used for vertical tows. No further description on operation will be provided unless a special request is made.



Info. provided by: J. Clark

12-Nov-98

SLED (Epibenthic Sled)



The epibenthic sled is designed for near-bottom sampling, and uses an opening and closing net device (1 meter Tucker). This prevents the samples from near-bottom depths being contaminated by material from the upper strata when lowering and raising the gear. Opening and closing of the net is controlled by a double-trip release mechanism on the tow cable above the bridle.

Assembly

ITEMS REQUIRED:

- sled runners
- net frame assembly
- bridle (should be in Tucker box)
- lead weights (6)
- wooden Tucker box containing nuts, bolts, net slides, etc.
- misc. (tools, tape, seine twine,etc.)

- Stand runners on back deck, noting that there is a difference between the left and right runner.
- Unravel net frame assembly. The pipe with the turnbuckle underneath is the bottom bar. Align with the net slide bars facing back.
- Insert frame pipes into sled runners. Some twisting and hammering is usually required so that the holes line up before inserting bolts.
- Use eye-bolts in top bar for attaching bridle. (I can't remember if only the eye-bolts are used or if they are in addition to other bolts, just fill all the holes with something.)
- Make sure the side cables are as tight as possible. They should be fairly tight already, but adjustments can be made using the turnbuckle. Use electrical tape to wrap any wire strands, hose clamp ends, etc. that might snag or rip the nets (the tape also helps to hold the bottom slide bar onto the bottom pipe).
- Attach the weights to the runner skis, three per side and evenly spaced. If hose clamps are not attached to the runners, insert them between the welds under the square brace that runs the length of the runner. Use small blocks of wood (in Tucker box) as spacers between the clamp and square brace.
- Attach the nets to the frame, the same as with the Tucker trawl, except the top net needs to be lashed to the cross pipe with heavy seine twine. The tripping mechanism is connected as it is for the Tucker trawl. Make sure you have the large bore tripping weights ready at start of tow to fit on cable being used.

SLED (cont'd)

Rates/Fishing
The sled is deployed off the stern ramp (on the Miller Freeman). A depth monitoring device is very helpful to determine when the sled is fishing at or near bottom (electronic BKG or Scanmar). If no depth device is available, estimate the wire angle and use the cosine of the angle to help determine wire out (i.e. 55 degree wire angle, .574 cosine, 200 meter target depth, 200/.574=348 m wire out). The wire between the ship and sled will not be a straight line, so the wire angle is just a guideline (more or less may be required to achieve best results).
The ship speed while towing the sled should be at 1.5 - 2.0 knots.
Wire out speed should be 40 m/min.
Wire in speed may depend on a number of factors. If the top net (from bottom to surface) is to be saved, wire in speed should be about 20 m/min. If the top net is not saved, the winch may be retrieved up to 40 m/min. Depending on what winch is used, and the condition of the winch, a steady rate may be difficult. Record as much information as possible on the data sheet regarding winch speeds.
Lately, a LG-CB net has been placed inside the sled net, and a flowmeter inside the LG-CB with counts being used by both the sled and LG-CB. If there is no LG-CB inside the sled, a flowmeter should be strung inside the nets when a quantitative tow is desired.

Preservation
Preservation will depend on cruise requirements, but it will usually be QTOWF.

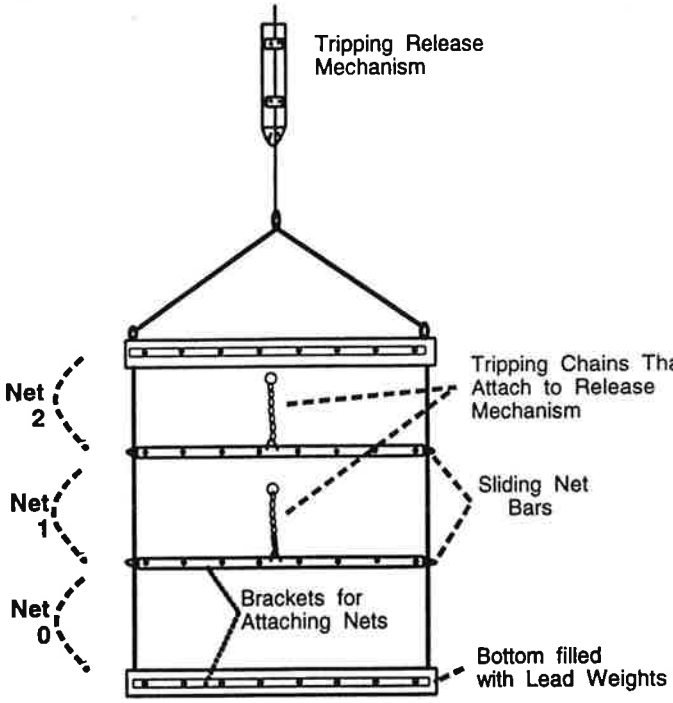
Maintenance
The maintenance for the sled is basically the same as for the Tucker:
- check nets for holes, and repair or replace
- check flowmeters for damage, fill with water if needed
- make sure tripping mechanism and chains are at proper tension
- spray tripping mechanism with WD-40

SM-CB (Small Clarke-Bumpus Net)

The small Clarke-Bumpus (SM-CB) nets are usually used in conjunction with a Tucker Trawl. A SM-CB may also be placed inside the Methot net. A flowmeter may be strung across the mouth opening of a SM-CB. No further description on the operation of this gear will be provided unless a special request is made.

TUCK1 (1 Meter Tucker trawl)

The tucker trawl has rectangular-mouth nets for horizontal or oblique tows, mounted on an opening-closing frame. Up to three nets may be operated sequentially during a tow, using a double trip release mechanism. The frame consists of two steel pipes connected with side wires on which slide two net bars. The bottom pipe is filled with lead weights.



Back of Tucker Trawl Frame

Assembly

- Attach the Tucker to an overhead support (or boom) to partially lift the frame making the net bars more accessible for attaching the nets. Keep the weighted bar on deck to prevent the frame from swinging.
- Attach the top of net 2 to the bracket on the top pipe using the sliders attached to the net. Make sure when attaching all of the nets that they are oriented correctly since it is easy to get the top and bottom confused. The Tucker flies at about a 45 degree angle, so the 'longer' portion of the net is the top (see diagram).
- Get the middle net (net 1) ready to attach. Alternate attaching the sliders to the net bar between the top net and the middle net, starting with the net that has seven sliders (the other has six).
- Grab the tripping chains on the net bars for the nets installed, lift, and secure out of the way.
- Attach the bottom net (net 0, 505 um) in the same manner, alternating the sliders between the middle and bottom net. After attaching the bottom net to the sliding net bar, attach to bottom lead pipe with sliders.

NET PROFILE

Info. provided by: J. Clark

12-Nov-98

TUCK1 (cont'd)

- On the corner of each net there should be a brass 'D' ring. Use this ring and a one inch shackle (provided) to anchor the nets to the net bars.
- Using the one inch shackles, attach the sides of the nets to the side cables on the frame. Attach the release mechanism to the cable using the clamps on the release. Initial installation should not be too tight as adjustments up or down the cable will probably be required. Make sure the bolts used to clamp onto the cable do not interfere with the portion of the release that rotates. If necessary add a washer as a spacer so release moves freely. Orient the release so the clamps are facing aft towards the nets, allowing the tripping chains to fall freely.
- Lift the Tucker with a winch off the deck (or enough to provide tension on all cables). Test the length of the tripping chains by attaching them to appropriate marked slot in the release. If required, alter the length of the chains and/or move the release on the cable.
- The bridle should be taking most of the weight, but the tripping chains need to be tight when the sliding net bars are at the top of the frame so that the middle and top nets are completely closed.
- After the release is in position, tighten the bolts on the clamp. Tie down or tape any loose ends of chain that might hang up during a net release. If there are any sharp corners, (things sticking out on the termination, etc.), then these will need to be taped.
- During deployment, care must be taken not to bump the top of the release mechanism with the block, or it will trip.
- To attach the rings from the tripping chains to the release, the ring from the top net bar is attached first, then the bottom. Sometimes hitting the top of the release makes it easier to turn after inserting the ring in its' slot (make sure it clicks and is locked before deployment).
- String a flowmeter inside each net using heavy monofilament and nico-press sleeves. The drogue (net 0) will not need a flowmeter unless a sample is requested from this net. If Clarke-Bumpus nets are to be placed in Nets 1 and 2, then flowmeters will not need to be strung inside the Tucker nets.

Fishing/Rates

The rates for normal Tucker operations are:

- ship's speed about 1.5 - 2.0 knots to achieve a 45 degree towing angle
- 50 m/min wire out speed
- 20 m/min wire in speed

Preservation

Preservation will depend on cruise requirements, but will usually be QTOWF.

Maintenance

The maintenance for the Tucker should be as follows:

- check nets for holes
- check flowmeters for damage and fill with water if needed
- adjust tripping mechanism so chains have proper tension
- spray tripping mechanism with WD-40

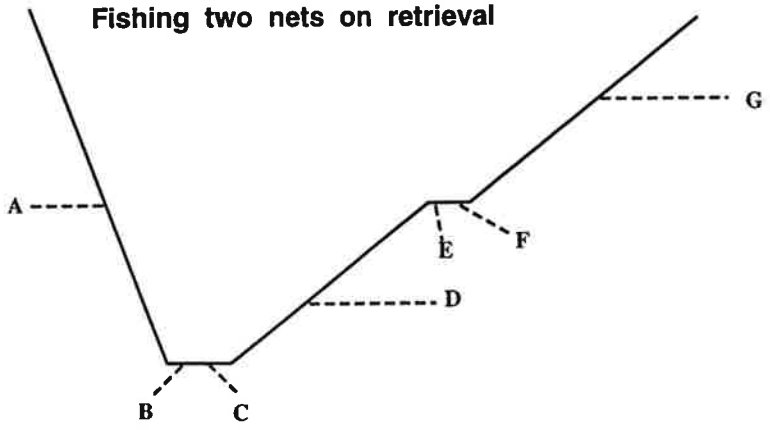
Info. provided by: J. Clark

12-Nov-98

TUCK1 (cont'd)

TUCKER TRAWL

Fishing two nets on retrieval



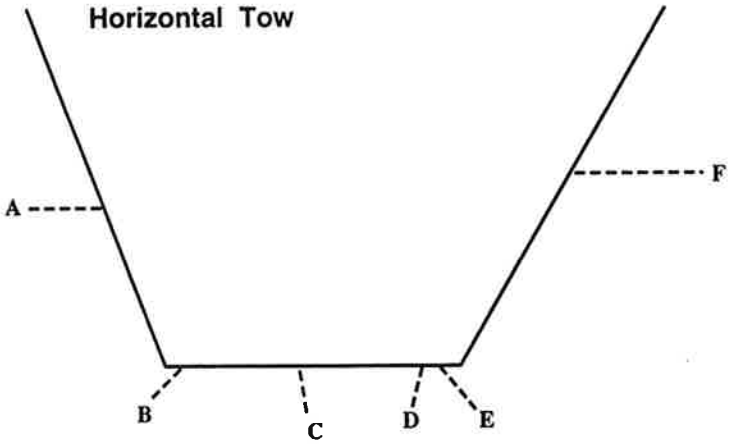
A—— Sinking, NET 0
B—— First Messenger
> NET 0

C—— At Depth, NET 1
D—— Haul In, NET 1
E—— Second Messenger
> NET 1

F—— At Depth, NET 2
G——Haul In, NET 2
> NET 2

TUCKER TRAWL

Horizontal Tow



A—— Sinking, NET 0
B—— First Messenger
> NET 0

C—— At Depth, Haul Time NET 1
D—— Second Messenger
> NET 1

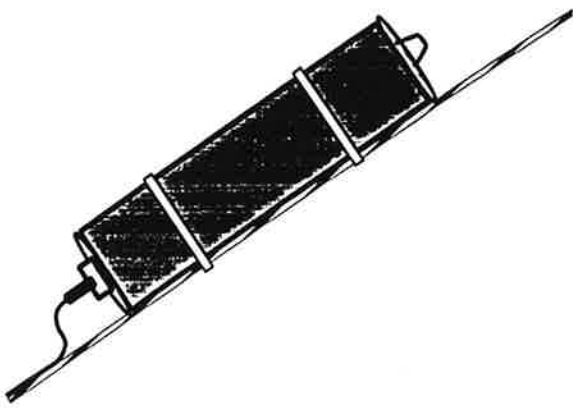
E—— At Depth, NET 2
F——Haul In, NET 2
> NET 2

CAT (SEACAT Attached to CTD)

A SeaBird SEACAT is attached to the CTD to measure conductivity, temperature, and depth in the water column. Instructions regarding the operation of this gear are not included at this time. Currently, the operation of this equipment is conducted by personnel from the Pacific Marine Environmental Laboratory (PMEL) and/or the Survey Department.

EBKG (Electronic Bathykymograph)

The EBKG was developed to provide a real time depth readout for plankton tows. Temperature is also recorded, but the sensor on the unit is not capable of responding properly at the speeds we operate.



Assembly

There is a green, wooden suitcase that contains the EBKG probe and deck units needed for operation. There should be a manual inside the case or in Dataplot that gives instructions on setup and operations. The Survey Tech or Electrician Tech will be required to terminate the probe onto the towing cable.

Rates/Fishing

Readout from the EBKG may be viewed in Dataplot (on the Miller Freeman) on a digital display, and also as a computer file recorded on the portable Compaq. Instructions should be with the equipment regarding starting and saving the files. Record in a green notebook the wireout, max depth, and bottom depth for each station the EBKG is used. The person in Dataplot monitoring the depth should also give the winch operator instructions over the radio on rates, when to start or stop the winch, and appropriate warnings to avoid problems.

NETFLUOR (Fluorometer During A Net Tow)

Fluorescence is measured using a fluorometer attached to the winch cable during a net tow. Instructions to operate this gear are not included at this time. Currently, operation of this instrument is done by PMEL and the Survey department.

SCANMAR

SCANMAR is used to determine the depth fished as well as the mouth opening characteristics of the trawl gear being fished. With SCANMAR attached to the Methot and other large net frames, it is possible to obtain a real time towing depth. The setup and operation of the SCANMAR unit is conducted by trained personnel only.

VIDEONET (Video Camera Attached To A Net Tow)

The use of video cameras is relatively new to FOCI and no set protocol exists at this time. If the gear is requested, then the appropriate instructions will be given.

BOTTLES (Niskin Bottles Without CTD)

Instructions regarding operation of this gear are not included at this time. Currently, operation of this instrument is conducted by PMEL and/or the Survey Department. Niskin bottle collections are described in this manual by sample type.

CTD (CTD Cast)

A SeaBird CTD is used to measure conductivity, temperature and depth in the water column. Instructions regarding operation of this gear are not included at this time. Currently, operation of this instrument is conducted by PMEL and/or the Survey Department.

CTDB (CTD Cast With Niskin Bottles)

A SeaBird CTD is used to measure conductivity, temperature and depth in the water column in conjuction with samples collected from Niskin bottles. Instructions regarding operation of this gear are not included at this time. Currently, operation of this instrument is conducted by PMEL and/or the Survey Department. Niskin bottle collections are described in this manual by sample type.

VIDEOCTD (Video Camera Attached To CTD)

The use of video cameras is relatively new to FOCI and no set protocol exists at this time. When the gear is requested, appropriate instructions will be given.

ANCHO (Anchovy Trawl)

The most common purpose of the anchovy trawl is to collect age-0 pollock or predators.

Description/Assembly

A fishing crew is required to setup and fish this gear. Advance warning should be given to the Bridge so that all required personnel may be notified. The anchovy trawl is fished with the 5'x7' steel v-doors weighing 1,250 lbs. Using other doors may inhibit the fishing performance of the trawls or overstress their construction. If the 5'x7' doors are ready, the only at-sea preparation is to load the nets onto the net reel.

Rates/Fishing

Towing Speed: 2.5 - 3.0 knots

The anchovy trawl is designed to fish midwater. A Furuno net sounder is attached to the net to enable accurate positioning by depth and to monitor the catch.

Acoustic information (usually from the Simrad EK-500) regarding the distribution of sound scatterers is often intimately associated with making decisions as to the depths and durations this net is fished. In the absence of acoustic data, the rule of thumb is to fish at depth for 20 minutes for single-layer tows, or a retrieval rate of about 10 m/min for oblique tows. Scanmar sensors are sometimes used to study the mouth opening dimensions. These are necessary for standardizing the catch and are as follows (all measurements are in meters)(Wilson et al.,1996):

Anchovy Trawl

EQ 1) Width=15.253(1-e(-0.012(WireOut+43.762))

EQ 2) Height=13.249-0.018(WireOut)

The path over which the net is fished depends upon the objectives of each tow. The oblique path may be more effective at catching age-0 pollock because ship speed coupled with wire retrieval rate increases the net speed through the water.

ANCHO (cont'd)

Record Keeping

For each tow, take notes indicating net depth and wire out every couple of minutes. These notes begin when the doors enter the water. Document net position until the doors are brought back out of the water. It is of particular interest to have this information when the doors are shot, when the net reaches equilibrium, when haul back begins, and when it reaches the surface. Since the Furuno data is not logged to a computer, it is often desirable to also attach a Scanmar depth sensor to the net.

The **Haul-Position Form** is filled out by the Bridge during the tow but some advanced discussion regarding some of entries (eg., gear code) is necessary. Distance fished and wireout are recorded for standardizing the catch.

Data logging has been facilitated by using the Resource Assessment and Conservation Engineering (RACE) programs used for the groundfish surveys. Entering data with these programs is too detailed to expand upon here but may be learned easily with practice. There are a few important cautions which must be heeded. First, both the RACE data entry programs and the Polycorder programs require that a printer be hooked up to the computer since printouts are generated during the entry/download procedure. Second, the RACE data entry programs are not designed for the complex station-haul designations often used by FOCI and the wide range in weight of taxa-specific biomass often caught during the FOCI age-0 field operations. The primary problem is that weights can only be entered to the nearest tenth, and are assumed to be in pounds. Until we have a more accommodating method, **meticulously record weight units on the On-Deck Sampling Form for each taxa.**

The RACE data entry program automatically expands the observed catch data to that for the entire tow using proportions. This is an important point and understanding it may be required at sea. For example, assume the entire catch was sorted, and the Non-Sub and Sub weight units for our example taxa are in kilograms.

The Total Number caught for our example taxa is:

Non-Sub Weight (kg) * (Sub Number / Sub Weight (kg)) + Sub Number. **(EQ1)**

Note that the Sub Number was added in. If the Non-Sub was weighed before the Sub was taken out, then the Sub Number should not be added in. Had the entire catch not been sorted (ie., the whole catch was weighed using the load cell and then only a portion was sorted), then the total number caught for our example taxa is:

(Total Number from EQ 1) * ((total animal weight from the load cell) / (total weight of all taxa sorted)).

ANCHO (cont'd)

Forms to be used during record keeping and catch processing are:
On-Deck Sampling Form
Age-0 Length Form
Log Book for depth and wire out

Catch Processing
It is desirable to quantify the entire catch, if possible. If subsampling is necessary, then first weigh the bag full and then empty using a load cell (record weight and weight unit (ie., lbs)). All species in the randomly selected subsample must be sorted and weighed. If there is a large size difference between adult and juvenile groups, then (for subsampling purposes) treat each as a separate species (see Catch Processing Chart). The wide range in species-specific weights encountered during the FOCI age-0 field operations necessitates the use of scales with varying sensitivities. Thus, it is imperative that with each weight recorded, its unit also be recorded. All catch information is recorded on the **On-Deck Sampling Form**. On this form, the Non-Sub column is for that portion of each taxa that was weighed but not enumerated. The Sub columns are for those portions which were weighed and enumerated. If the lengths of any taxa are to be measured, the portion selected for enumerating (eg., that amount recorded as Sub) can be set aside and the number of individuals tallied from the length frequency data.

Lengths of large specimens of commercially important species should be measured to the nearest centimeter. Measuring larger specimens is expedited by using the Polycorders and associated software. Smaller specimens should be measured to the nearest millimeter using the small length boards. Although the length measured is usually fork or total, it is sometimes necessary to measure standard length. Be sure to record which length type was measured.

Once separated from the invertebrates, sort the fish to lowest taxonomic order (pay particular attention to sorting cod and pollock from each other). For each species, measure the total weight and count. If the total weight of a species is very small (< 2 g) record its weight as < 2 g. If a species other than pollock is very abundant, randomly select 50 fish and measure their lengths in SL, TL, or FL in mm (use whichever is easiest but make sure to note the length type and units on the **Age-0 Length Form**).

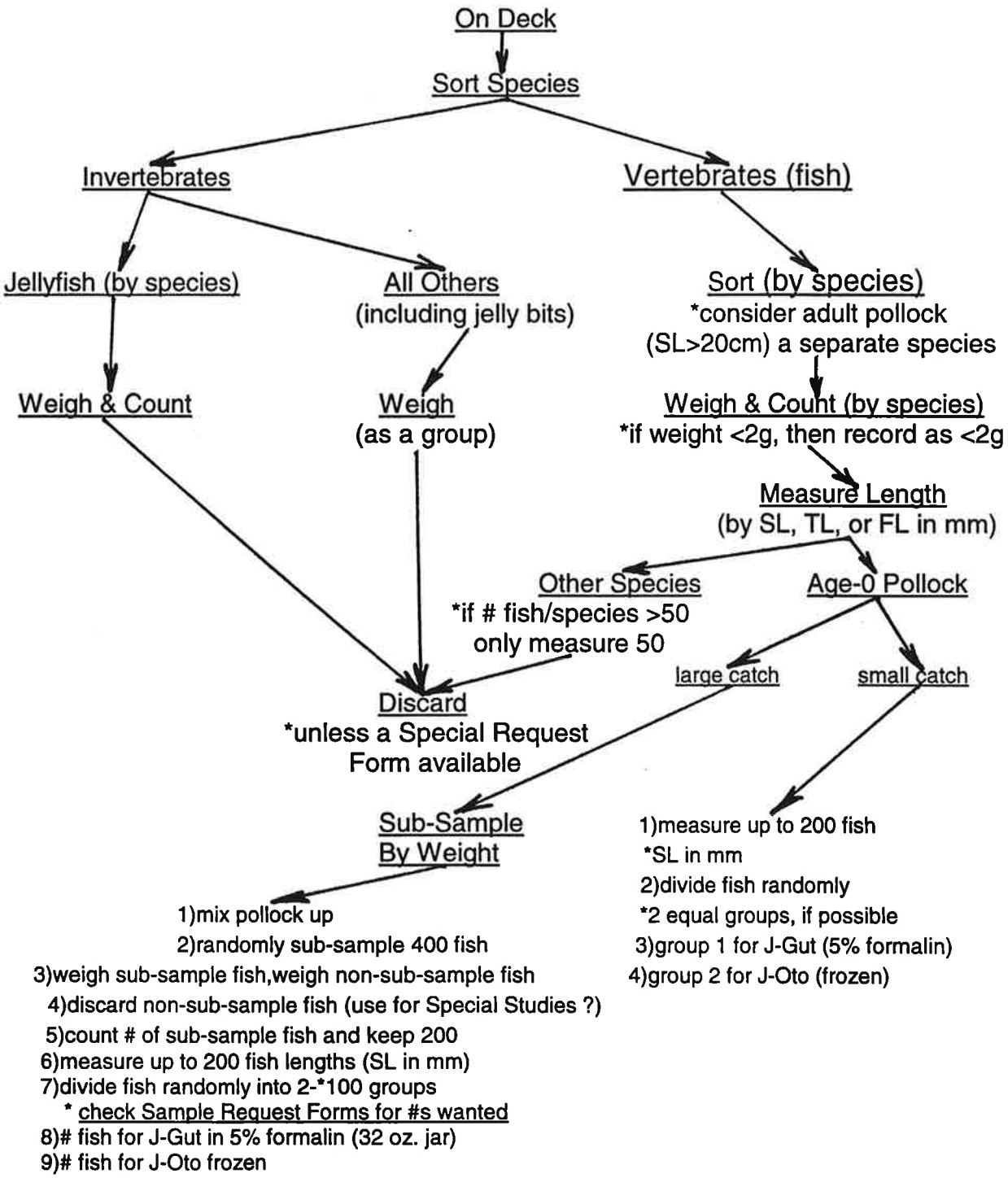
ANCHO (cont'd)

If the number of pollock is in the thousands, then subsampling by weight will be necessary. Randomly select a subsample of about 400 individuals and weigh the remainder to the nearest gram. Record this weight in the Non-Sub entry on the On-Deck Sampling Form. For the sub-sample, record its weight and number of fish as Sub-Weight and Sub-Num. From the sub-sample, randomly select about 200 fish and measure their standard lengths in mm and record data on the Age-0 Length Form. After measuring, freeze about 25-50 fish (for age and growth studies) and put another 25-50 in 5% formalin (for diet studies) and note numbers of each preservative type on the On-Deck Sampling Form. See the Sample Request Forms and the **Catch Processing Chart** for further details.

References:
Wilson, M. T., R. D. Brodeur, and S. Hinckley. 1996. Distribution of age-0 walleye pollock (Theragra chalcogramma) in the western Gulf of Alaska. In: R. D. Brodeur, P. A. Livingston, T. R. Loughlin, and A. B. Hollowed (eds.), Ecology of Juvenile Walleye Pollock, p. 11-24. U. S. Dep. Commer., NOAA Tech. Rep. NMFS 126.

Catch Processing Chart

Anchovy Trawl



DIAM (Diamond Midwater Trawl)

The Diamond trawl is fished midwater and often used to acquire ripe, spawning pollock so that eggs and sperm may be stripped and used in rearing experiments. A fishing crew is required to fish this net, so advance warning should be given to the Bridge. The Chief Scientist should have information as to what forms are required for this gear, and if there is any catch processing involved.

EASTERN (83-112 Eastern Bottom Trawl)

The 83-112 Eastern is a bottom otter trawl which is used to acquire ripe, spawning pollock so that eggs and sperm may be stripped and used in rearing experiments. This gear is also used for the collection of juvenile pollock predators.

Description/Assembly

A fishing crew is required to setup and fish this gear. Advance warning should be given to the Bridge so that all required personnel may be notified.

Rates/Fishing

Towing Speed: 2.5 - 3.0 knots

The Eastern bottom trawl is designed to fish on the ocean bottom. A Furuno net sounder is attached to the net to enable accurate depth positioning and monitoring of the catch.

Record Keeping

The Haul Position Form is filled out by the Bridge during the tow but some advanced discussion regarding some of the entries (e.g., gear code) is necessary. Distance fished and wireout are recorded for standardizing the catch.

Data logging has been facilitated by using the RACE programs used for the groundfish surveys. Entering data with these programs is too detailed to expand upon here but it may be learned easily. There are a few important cautions which must be heeded. First, both the RACE data entry program and the Polycorder program require that a printer be hooked up to the computer since printouts are generated during the entry/download procedure. Second, the RACE data entry programs are not designed for the complex station-haul designations often used by FOCI and the wide range in weight of taxa specific biomass often caught during the FOCI age-0 field operations. The primary problem is that weights can only be entered to the nearest tenth and are assumed to be in pounds.

EASTERN (cont'd)

Until we have a more accommodating method, **meticulously record weight units on the On-Deck Sampling Form for each taxa.** The RACE data entry programs automatically expands the observed catch data to that for the entire tow using proportions. This is an important point and understanding it may be required. For example, let us assume the entire catch was sorted, and the Non-Sub and Sub-Weight units for our example taxa are in kilograms.

The Total Number Caught for our example taxa is:

Non-Sub Weight (kg) X (Sub Number/ Sub Weight (kg)) + Sub Number (EQ 1)

Note that the Sub Number was added in. If the Non-Sub was weighed before the Sub was taken out, then the Sub Number should not be added in. Had the entire catch not been sorted (i.e., the whole catch was weighed using the load cell and then only a portion was sorted), then the total number caught for our example taxa is:

Total Number from EQ 1 X ((total animal weight from the load cell) / (total weight of all taxa sorted)).

Forms to be used during record keeping and catch processing are:
On-Deck Sampling Form
Length Frequency Form
Age-0 Length Form

Catch Processing (for age-0 pollock predator study)
This trawl is fished on the bottom and is used to collect species of fish that may consume age-0 pollock. The predators of interest are listed on the Catch Processing Chart. All of the fish of interest (up to 100 fish, if available) should be lengthed using the Polycorder regardless of the number of individuals that will be used for stomach analysis. Some of individuals will have their stomachs removed and hence should be weighed and processed immediately so that digestion does not proceed any further. Sort all fish to species. Typically, there will not be any age-0 gadids in this type of trawl since it does not have a small mesh liner. If any age-0 gadids are caught, then they should be counted, weighed, and 100 fish lengthed. Use the Age-0 Length Form to record the length data. For each vertebrate species, get a total weight and count. For the invertebrates, sort out only the jellies, squid, shrimp, and crabs. All other species such as starfish, sponges, molluscs, etc. can be combined and weighed together and designated as shab. Jellies caught in this trawl are usually in bad condition so weigh all jellies combined. For crab, sort to species and weigh and count each species. Weigh and count squid and shrimp by groups (do not sort to species). Discard the invertebrates and vertebrates after processing unless a Special Request Form is available to give instructions for specimen collection.

Catch Processing Chart

Bottom Trawl

On Deck

Sort Species

Invertebrates

Sort (into groups)
*jellyfish (not by species)
*shrimp
*squid
*crabs (by commercial species)
King (blue, red, gold)
Tanner (hybrid, Opilio, Bairdi)
Korean horsehair
*other(shab)

Weigh & Count (by group)
*weigh shab only, do not count
*jellyfish may not be countable

Discard
a Special Request Form available

Vertebrates (fish)

Sort (by species)
*consider adult and juvenile pollock (< 20 cm) separate species

Count & Weigh (by species)

Measure Length (100 of each listed)
(by TL or FL in cm using polycorder)
*adult pollock
*juvenile pollock (< 20 cm)
*Pacific cod
*sablefish
*rockfish
*flathead sole
*Alaska plaice
*arrowtooth flounder *unless
*Greenland turbot
*Kamchatka flounder
*halibut

Discard
* unless a Special Request Form available

MARIN (Marinovich Midwater Trawl)

The Marinovich is a midwater trawl used to acquire ripe, spawning pollock so that eggs and sperm may be stripped and used in rearing experiments. A fishing crew is required to fish this net, so advance warning should be given to the Bridge. The Chief Scientist should have information as to what forms are required for this net and if there is any catch processing involved.

NOR (Nor'eastern Bottom Trawl)

The Nor'eastern is a bottom trawl used to acquire ripe, spawning pollock so that eggs and sperm may be stripped and used in rearing experiments. A fishing crew is required to fish this net, so advance warning should be given to the Bridge. The Chief Scientist should have information as to what forms are required for this gear and if there is any catch processing involved.

ROPE (Rope Midwater Trawl)

The rope trawl is a large midwater trawl used to acquire ripe, spawning pollock so that eggs and sperm may be stripped and used in rearing experiments. A fishing crew is required to fish this net, so advance warning should be given to the Bridge. The Chief Scientist should have information as to what forms are required for this net and if there is any catch processing involved.

SHRIMP (Shrimp Trawl)

The most common purpose of the shrimp trawl is to collect age-0 pollock or predators.

Assembly/Preparation

The shrimp trawl is fished with the 5' x 7' steel v-doors weighing 1,250 lbs. Using other doors may inhibit the fishing performance of the trawls or overstress their construction. If the 5' x 7' doors are ready, the only at sea preparation is to load the nets onto the net reel. See illustration on page 4 of 4 for trawl dimensions and mesh sizes.

Fishing/Rates

Towing Speed: 2.5 - 3.0 knots

A fishing crew is required to fish this gear. Sufficient advance warning must be given to the Bridge. The shrimp trawl is designed to fish on bottom but it may also be fished midwater. A Furuno net sounder is attached to the net to enable accurate positioning by depth and to monitor the catch. Acoustic information (usually from the Simrad EK-500) regarding the distribution of sound scatterers is often intimately associated with making decisions as to the depths and durations this net is fished. In the absence of acoustic data, a rule of thumb is to fish at depth for 20 minutes for single layer tows or a retrieval rate of about 10 m/min for oblique tows. Scanmar sensors have also been used to study the mouth opening dimensions. These are necessary for standardizing the catch and are as follows (all measurements are in meters)(Wilson et al. 1996):

Shrimp Trawl

EQ 1) Width=15.1(1-e(-0.02(WireOut+35.1))

EQ 2) Height=2.2-0.004(WireOut)

The path over which the net is fished depends upon the objectives of each tow. The oblique path may be more effective at catching age-0 pollock since boat speed coupled with wire retrieval increases the net speed through the water.

SHRIMP (cont'd)

Record Keeping

For each tow, take notes indicating net depth and wire out every couple of minutes. These notes should start when the doors enter the water. Document net position until the doors are brought back out of the water. It is of particular interest to have this information when the doors are shot, when the net reaches equilibrium, when haul back begins, and when it reaches the surface. Because the Furuno data is not logged to a computer it is sometimes desireable to also attach a Scanmar depth sensor to the net (Scanmar sensors are managed by David Roetscisoender and can be requested from Craig Rose).

The **Haul-Position Form** is filled out by the Bridge during the tow but some advanced discussion regarding some of entries (eg., gear code) is necessary. Distance fished and wireout are recorded for standardizing the catch. In the past, data logging has been facilitated by using the RACE programs used for the groundfish surveys. Entering data with these programs is too detailed to expand upon here but can be learned easily. However, there are a few important cautions. First, both the RACE data entry programs and the Polycorder programs require that a printer be hooked to the computer because printouts are necessarily generated during the entry/download procedure. Second, the RACE data entry programs are not designed for the complex station-haul designations often used by FOCI and the wide range in weight of taxa-specific biomass often caught during the FOCI age-0 field operations. The primary problem is that weights can only be entered to the nearest tenth, and are assumed to be in pounds. Until we have a more accommodating method, **meticulously record weight units on the catch form for each taxa**. The RACE data entry program automatically expands the observed catch data to that for the entire tow using proportions. This is an important point and understanding it may be required at sea. For example, assume the entire catch was sorted, and the Non-Sub and Sub weight units for our example taxa are kilograms.

Then, the Total Number caught for our example taxa is:

EQ 5) Non-Sub Weight (kg) * (Sub Number / Sub Weight (kg)) + Sub Number.

Note that the Sub Number was added in, if the Non-Sub was weighed before the Sub was taken out, then the Sub Number should not be added in. Had the entire catch not been sorted (ie., the whole catch was weighed using the load cell and then only a portion was sorted) then the total number caught for our example taxa is:

EQ 6) (Total Number from EQ 1) * ((total animal weight from the load cell) / (total weight of all taxa sorted)).

Other forms used during catch processing are: **On-Deck Catch Form, Length Frequency Form.**

SHRIMP (cont'd)

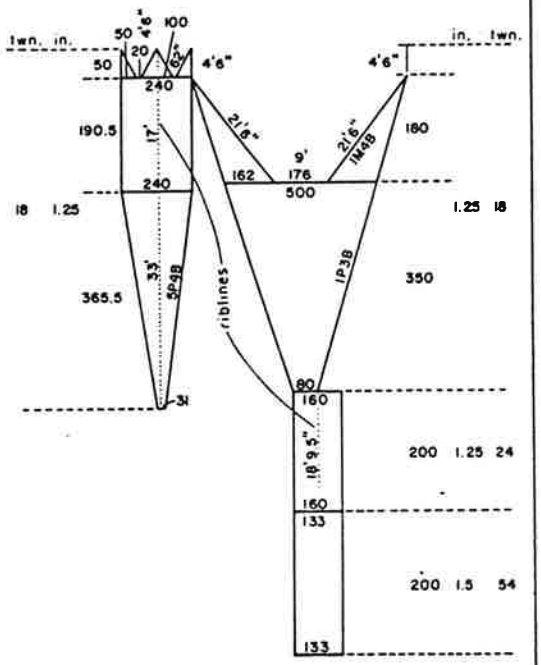
Catch Processing

It is desireable to quantify the entire catch if possible. If subsampling is necessary, then first weigh the bag full and then empty using a load cell (record weight and weight unit (ie., lbs)). All taxa must be sorted from the randomly selected subsample and weighed. If there is a large size difference between adult and juvenile groups, then for subsampling purposes, treat each as a separate taxa. Enumerate the number of individuals comprising all, or a weighed subsample, of the biomass of each taxa. The wide range in taxa-specific weights encountered during the FOCI age-0 field operations necessitate the use of scales with varying sensitivities (eg., one weighing in grams and another weighing in kilograms). Thus, it is imperative that each weight be recorded with its unit.

All catch information is recorded on the **On-Deck Catch Form**. On this form, the Non-Sub column is for that portion of each taxa that was weighed but not enumerated. The Sub columns are for that portion which was weighed and enumerated. If the lengths of any taxa are to be measured, the portion selected for enumerating (eg., that amount recorded as Sub) can be set aside and the number of individuals tallied from the length frequency data.

Often, 150 individuals of each taxa is sufficient to generate a good length frequency distribution. Lengths of large specimens of commercially important species should be measured to the nearest centimeter. Measuring these larger specimens is expedited by using the Polycorders and associated software which are managed by Robin Harrison of the RACE Division and may be borrowed by special request through Dave Somerton. Smaller specimens should be measured to the nearest millimeter. The length measured is usually fork or total. Standard length is measured on post-larval young-of-the-year pollock because the caudal fin is often damaged or its posterior margin is difficult to see. Be sure to record which length was measured. If the size distribution of each taxa is broad, then it may be necessary to measure more than 150 individuals.

SHRIMP (cont'd)



61' SHRIMP SAMPLING TRAWL

Netting—nylon, preshrunk.
Headrope—61 ft of ⅜ in 6 × 19 galvanized wire rope, tight wrapped with 5/16 in polypropylene rope.
Footrope—61 ft of ½ in, 6 × 19 galvanized wire rope, tight wrapped with ½ in polypropylene rope.
Breastlines—20 ft of ½ in braided nylon (Stablebraid).
Sidepanel riblines—73 ft 3½ in of ⅝ in braided nylon (Stablebraid).
Flotation—29 pieces, 8 in diameter (5.5 lb buoyancy each).
Footrope chain—60 ft of ⅜ in suspended with six 12-in chain droppers (⅜ in diameter).
Tickler chain—55 ft of ⅜ in secured at wing tips.
Otterboards—5 × 7 ft V-doors, 815 lb.
Dandylines (sweeplines)—3 pieces, 10 fathoms each, top and middle of ⅜ in diameter, 6 × 19 galvanized wire rope, bottom of ½ in diameter; top with 24 in extension and middle with 18 in extension—both of ⅜ in proof coil chain.

References:
Wilson, M. T., R. D. Brodeur, and S. Hinckley. 1996. Distribution of age-0 walleye pollock (*Theragra chalcogramma*) in the western Gulf of Alaska. In: R.D. Brodeur, P. A. Livingston, T. R. Loughlin, and B. Hollowed (eds.), Ecology of Juvenile Walleye Pollock, p. 11-24. U. S. Dep. Commer., NOAA Tech. Rep. NMFS 126.

Photo credit: Wathne, F. 1977. Performance of trawls used in resource assessment. Mar.Fish.Rev. 16-23.

Info. provided by: M. Wilson / A. Brown

12-Nov-98

BKG (Manual Bathykymograph)

The bathykymograph (BKG) produces a record of the depth profile of a tow and provides a measure of the maximum depth of a tow. The BKG is designed to relate the magnitude of compression of a spring within the instrument to the pressure applied to that spring. This results in a linear increase in the compression of the spring with increasing pressure and depth. Spring compression is recorded by a stylus that marks a sheet of chart paper. The chart paper is secured to an immobile drum and the stylus rotates around the drum driven by a clock. A profile of the tow results from the horizontal rotation (time) occurring simultaneously with vertical movements due to changes in spring compression (depth). The shape of the trace reflects the time vs depth character of the tow. The maximum vertical deflection of the stylus on the trace is measured and related to a calibration curve to obtain the depth of tow.

Preparation

Remove the housing, secure the chart paper to the recording drum, wind the clock drive, position the stylus, and replace the housing to seal the instrument. When the BKG is not in use, turn the knob at the top of the BKG counterclockwise. The clock drive is disabled in this position and no trace is produced. To prepare for a tow, secure the BKG to the towing cable just above the bongo array (or on the Tucker bridle) by both snap hooks, attaching one or both snaps into a shackle to prevent sliding up the cable. Enable the chart drive a few minutes before the tow by turning the knob clockwise (ignoring the instructions that may be printed on the face of the knob). This will provide enough "shoulder" on the trace to establish a good baseline for measurement of the deflection. After retrieval of the nets, allow 1 - 2 minutes to pass before disabling the chart drive by turning the knob counterclockwise to provide the rest of the "shoulder". If a tow less than 75 meters is expected, use a unit with a 'shallow' spring installed (if available).

Evaluation

Remove the BKG from the wire, rinse the exterior with fresh water, remove the housing (using a punch if necessary to help rotate), and examine trace. Examine the trace for tow quality and redo the tow if the trace does not meet standards.

Labelling

Depending on the depth of the stations, four to five tows may be recorded on one piece of chart paper. After each tow, record on the trace: Cruise, Station, Haul number, and BKG unit number. Keep all the traces in a small folder. Record on the DSDB form that the BKG was used, and which unit it was (i.e. BKG III).

BKG (cont'd)

Maintenance

Do not disassemble the piston clock assembly. Each BKG has been calibrated for current internal conditions. Should it be opened and altered in any way, another calibration is necessary. Periodically spray lubricant into the clock mechanism and down the shaft onto the spring. A light application of silicone lubricant should occasionally be applied to the 'O' ring on the housing. If the unit floods constantly with water, there is probably a blown diaphram. Unless you know what you are doing, it is best not to try a replacement.

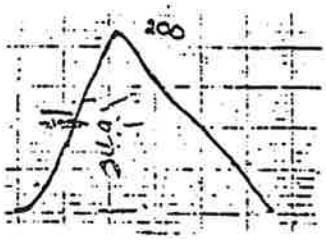
Calibration

All that is required for calibration is to send the unit down to known depths, holding at each depth for 2 - 3 minutes (to provide a good marker on the trace), and repeat for as many depths as practical (usually four or five). The best way to calibrate on NOAA vessels is hook the BKG onto the rosette and send it down with the CTD. A clean piece of chart paper should be secured to the recording drum. Be sure to enable the chart drive before the cast to provide a good baseline on the paper. The scientist and/or Survey Tech involved must record accurate depth readings taken from the CTD sensor when stopped at each depth. Record on the chart paper the stopping depths, cruise, date, BKG unit and store in a secure place.

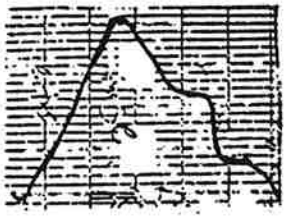
Examples

Acceptable tows.

Acceptable tow, but lacks baseline "shoulders".



Questionable tows, repeat if possible.



Info. provided by: Jay Clark

12-Nov-98

FLOWMETER

The General Oceanics digital flowmeter, Model 2030 with a 3 blade rotor is used to determine water volume associated with a plankton tow. The flowmeter incorporates a molded rotor coupled directly to a six digit counter which records to 1/10 of a revolution.

Calibration

The flowmeters are calibrated in a water flume, duplicating the normal operating speeds in which a flowmeter may be used.

Installation

The flowmeters are designed to be suspended by a twin bridle for most applications. The Neuston frame has a special bolt that fits in place of the lanyard pin. To remove or loosen the lanyard pin, the nosecone must be removed by unscrewing, then backing off the screw holding the pin in place. Use heavy monofilament attached with nicopress sleeves for the towing bridle.

Preparation

Remove the screw and 'O' ring found on the endplate. This provides access to the insides with a syringe. Fill the syringe with fresh water. Hold the flowmeter nose down and inject gently with water until full and little or no air bubbles are visible. Replace 'O' ring and screw. The flowmeters are not designed to be absolutely water tight, so check periodically and fill with water if needed.

Repair and Maintenance

After use, flush the inside and outside of the flowmeter with fresh water to remove any salt deposits. With the exception of the rotor and towing bridle, do not attempt any at-sea repairs. When a problem is found with one of the flowmeters, make a tag describing the problem and affix it to the problem flowmeter.

ASOUND (Atmospheric Weather Balloons)

The release of atmospheric weather balloons. Weather balloons are not released on a regular basis and hence instructions will be given when needed.

BIOOTHER (Other Biological Gear)

A biological gear that does not fall under any specific gear type. Be sure to include an explanation in the comments of the DSDB form.

MOOR (Oceanographic Mooring At Fixed Location)

Mooring deployment is performed by PMEL and the Survey Department.

PHYOTHER (Other Physical Gear)

Physical gear used that does not fall under any specific gear type. Be sure to include an explanation in the comments of the DSDB form.

SATBUOY (Satellite Tracked Drifter Deployment)

Satellite drifters deployment is performed by PMEL and the Survey Department.

Record Keeping

Be sure to note buoy identification number and drogue depth for DSDB entry. If this is an independent operation, then assign the operation an independent station number.

SEDTRAP (Sediment Trap)

The deployment or recovery of a sediment trap. Instructions regarding this gear will be given when requests are made.

SHIPBUOY (RADAR Tracked Drifter)

RADAR tracked drifters are deployed in larval "patches" and sampling may occur in areas near the drifter. Deployment and recovery are usually performed by the Deck Department.

TRANS (Dedicated Transect)

A dedicated transect is defined as a continuous underway collection of data (no stations between the start and end). This is not to be confused with the vessel mounted sensors that are logging data for the ship.

XBT (Expendable Bathythermogragh)

The use of XBTs has declined since better technology has been made available. They provide a quick method to obtain a temperature profile, even while underway. There are different probes available, depending on depths to be sampled.

Section: SAMPLING
List of Contents (by Discrete Sample Database code)

NET ELECTRONICS

CAT..... SEACAT CTD data collection
EBKG..... electronic bathykymograph data collection
NETFLOUR..... fluorometer attached to net tow
SCANMAR..... SCANMAR data collection
VIDEONET..... video camera attached to net tow

CTD/ROSETTE

ABSORB..... spectral absorbance samples
BKG-CAL..... calibration of manual bathykymograph
CHLAM..... chlorophyll absorption meter mounted on CTD
CHLOR..... chlorophyll samples
CTD..... CTD data collected
FLOUR..... fluorometer data collected
LUGOLS..... Lugol's preserved samples collected
MZ..... microzooplankton samples collected
NUT..... nutrient samples collected
PAR..... light meter data collected
PHYTOF..... phytoplankton samples preserved in formalin
POC..... particulate organic carbon samples
VIDEOCTD..... video camera attached to CTD

DEDICATED TRANSECTS

ADCP..... ADCP data collection
EK500..... EK500 data collection
SSF..... sea surface flourescence data collection
TSG..... thermosalinograph data collection

OTHER

ALGAE/JELLY PROBLEMS..... instructions for heavy algae/jelly tows
ASOUND..... atmospheric weather balloons
BIO-OTHER..... biological samples specially requested and have no assigned DSDB code
DEPLOY..... deployment of bouy or mooring
DISCARD..... discard of sample due to gear or sampling failure
LIVE..... live collections of organisms for at-sea experiments
PHYOTHER..... physical samples specially requested and have no assigned DSDB code
RECOVERY..... recovery of bouy or mooring
SURFACE CHLOROPHYLL..... surface chlorophyll samples
XBT..... expendable bathythermograph

PRED (Pollock Egg Predator Collections)

Collections of vertebrate and invertebrate predators larvae or eggs of walleye pollock for immunoassay. Collections can be made at any time of the day, preferably in areas of high egg or larval abundance as determined by bongo grid survey.

Preparation

Approximately 100 microcentrifuge tubes should be numbered for each tow (see Labelling section). Samples will be sorted over ice, so make sure there are sorting trays with seawater in the blast freezer. Locate Green Predator Log Book, forceps, stopwatch, test tube rack, freezer box, and pipettes.

Collection

Collections are made using the 1 meter Tucker trawl (TUCK1) with 500 um nets and 1.5 mm soft codends. In some cases, a Tucker sled (epibenthic sled) or Methot trawl with a 1.5 mm codend may be used to collect predators instead of the Tucker trawl. The Methot trawl should be sampled oblique from 250 meters or within 5 meters of the bottom.

Guidelines for GOA sampling:

<u>For egg and yolk-sac larvae sampling:</u>
Both TUCK1 nets should have a modified 10" Clarke-Bumpus (LG-CB) net with a flowmeter attached in the center of the Tucker net to collect egg abundance data. Flowmeter data for the TUCK1 will be supplied by the LG-CB.

Sampling Strategy:

Bottom depth > 250 meters	Bottom depth < 250 meters
Net 1 from 250 - 150 meters	Net 1 from 10 meters off bottom - 150 meters
Net 2 from 150 meters - surface	Net 2 from 150 meters - surface

Once on board, Nets 1 and 2 from the TUCK1 should be quickly washed down and the codends brought into the wet lab for sorting. Record the flowmeter readings from the LG-CB and wash down the nets after the samples are processed.

<u>Processing:</u>
At least two persons are needed to ensure timely processing of the samples and accurate recording of the data in the lab. One person will pick the samples and the other person will record the taxa and vial number in the log book. Net 2 should be sorted first by gently rinsing the contents into a tray with iced seawater on the bottom. Up to 10 large predators from each of the major predator taxa (i.e. euphausiids, hyperiid amphipods, gammarid amphipods, mysids, and chaetognaths) should be removed using larval forceps or pipettes and placed into individually numbered

PRED (cont'd)

microcentrifuge tubes. Repeat this process for net 1. **All predators should be placed in microcentrifuge tubes within 10 minutes after the codend comes on deck.**

Labelling
Microcentrifuge tubes are numbered in sequential order with 001 being the first sample of the field season. Check the Green Predator Log Book for the last number.

Preservation
The microcentrifuge tubes should be placed in a labelled white freezer box and put in the - 80 °C freezer as quickly as possible. Preserve the remaining part of the sample from each net in 5% formalin using 32 oz jars. Preserve the contents of the LG-CB nets in 5% formalin using 8 oz jars.

Record Keeping
The tow, net, microcentrifuge numbers, and major predator categories should be recorded in the Green Predator Log Book. Please note the station, haul, net number and depth fished for each net and any problems in the log book. Separate station collections with a bold line.

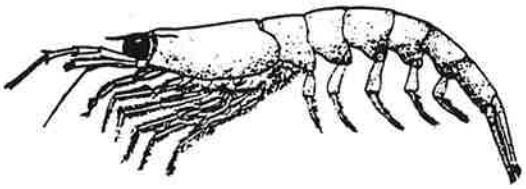
Miscellaneous
The next page has a table and figures that may be useful during predator sorting.

Photo Credits:
Euphausiid, Mysid, Chaetognath, Hyperiid Amphipod from: Newell, G. E. , R. C. Newell. 1963. Marine Plankton A Practical Guide. Hutchinson Educational Ltd., London, 207 p.

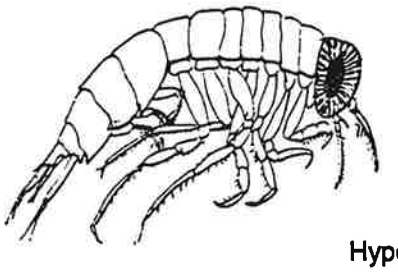
Gammarid Amphipod from: R. I. Smith, J. T. Carlton (editors), Light's Manual: Intertidal Invertebrates of the Central California Coast, 3 rd edition. Univ. California Press, Berkeley, 716 p.

PRED (cont'd)

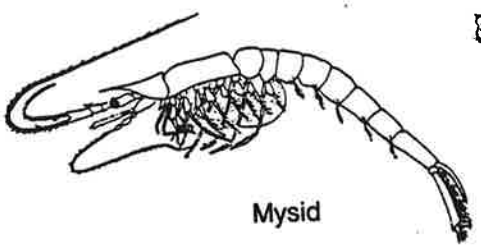
Predator Type	Species	Identifying Characteristics
Hyperiid amphipod	*Themisto pacifica*	*compound eye and purplish exoskeleton *large gnathopods (claws)
Hyperiid amphipod	*Primno macropa*	*compound eye and creamy white exoskeleton *large, spiked gnathopods (claws)
Gammarid amphipod	*Cyphocaris challengeri*	*creamy/whitish to yellowish exoskeleton *usually longer than wide *sometimes has dark orange line on dorsal side
Gammarid amphipod	*Anonyx* spp.	*large amphipod--about 2 to 3 times larger than other amphipods *white exoskeleton and pink eyes *usually in epibenthic layer
Euphausiid	*Thysanoessa* spp. or *Euphausia* spp.	*shrimp-like appearance *thoracic segments covered and fused with carapace *eyes are stalked
Mysidacea	*Meterythrops* spp.	*shrimp-like *red spot behind eyes



Euphausiid

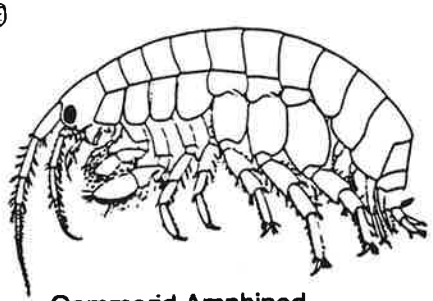


Hyperiid Amphipod



Mysid

Chaetognath



Gammarid Amphipod

Info. provided by: R. Brodeur / A. Brown

17-Aug-98

QTOWF (Quantitative Tow Preserved In Formalin)

A quantitative tow for eggs, larvae, or other preserved in 5% formalin.

Preparation

Prelabel jar(s) for preservation of codend contents.

Collection

Gears and mesh sizes will vary.

Labelling

Use the water proof Inside Jar labels for the inside of the jars which should be filled out in pencil. For outside labelling, use the self adhesive FOCI labels (USE PEN!). Remember to label the side of each box with the cruise, gear type, preservative, and box number.

Preservation

Rinse codend contents into sieve to reduce the amount of seawater before preservation. Using a wash bottle filled with seawater, rinse the sieve contents into a labelled 32 oz. jar. Add 50 ml of formaldehyde and 20 ml of sodium borate to the quart jar and add more seawater to fill jar to within 1/4" of lip (**shoulder of jar**). Add 12.5 ml of formaldehyde and 5 ml sodium borate for the 8 oz. jar. Screw cap on tightly and turn the jar end over end to mix sample and formaldehyde thoroughly. Place jar in appropriate box.

QTOWS (Quantitative Tow Preserved In Stockard's / by special request only)

A quantitative tow of pollock eggs taken by special request for preservation in Stockard's solution to study egg developmental stages.

Preparation

Make Stockard's solution before tow is complete.

50 ml 37% formaldehyde
40 ml acetic acid
60 ml glycerin
850 ml fresh water

Since you may need more than a liter of Stockard's at a time, it is best to make it up in an old gallon jug (milk jug from galley, distilled water jug, etc.) and transfer it to a wash bottle.

Have a prelabelled 32 oz. jar ready for use.

Collection

Gears and mesh sizes will vary.

Labelling

Labels should have Stockard's clearly written in one of the margins. Use a water proof Inside Jar label for the inside of the jar (fill out data fields in pencil). For outside labelling, use the self adhesive FOCI label (fill out data fields in PEN). Put jar in box labelled Stockard's on the side and the top in addition to the cruise and station number. Make sure that the Stockard's samples do not get placed in the same box as formalin samples.

Preservation

Gently transfer sample into 32 oz. jar using a wash bottle filled with 100% Stockard's solution. Top off jar with 100% Stockard's solution.

RCOUNTE (Rough Count)
A rough estimate of abundance obtained at sea. The following is for an egg rough count.

Preparation
Locate the following equipment for sub-sampling:

Stempel pipette (10 ml sub-sample)
quadrant petri dish
formalin sieve
large mesh sieve
5 gallon bucket (dead/formalin)
long forceps (dead/formalin)
vinyl gloves (when handling formalin)

Collection/Preservation
Samples to be rough counted must be preserved for 24 hours or longer. Gloves are provided for those who wish to use them for protection against formalin. The following procedures will be done in the Wet Lab on every 32 oz. jar collected from grid survey stations.

Select a jar of formalin preserved plankton to be rough counted. Remove Inside Jar label. Depress plunger on Stempel pipette, insert in jar, and stir the sample. When eggs are equally distributed throughout the jar, release the plunger and withdraw the pipette. Release sub-sample into quadrant dish. Count eggs using a dark background for contrast or use a microscope (whichever is easiest for you). To obtain the number of eggs per jar, multiply the number of eggs in the sub-sample by 85. Return sub-sample and original Inside Jar label to sample jar.

If a sample contains a lot of chaetognaths, then sieve the sample. Use formalin sieve (333 or 505 um) to separate plankton from formalin (save formalin in a spare 32 oz. jar to be used again). Put large mesh sieve on top of 5 gallon bucket and place in sink. Empty plankton into large sieve and rinse well with seawater to wash eggs into bucket (leave Inside Jar label with chaetognaths). Pour eggs through formalin sieve and then transfer into 32 oz. jar. Fill jar to the shoulder with seawater. Obtain sub-sample as outlined above. When sub-sampling is completed, pour contents of jar, contents of large mesh sieve (chaetognaths and label), and 5 gallon bucket into formalin sieve. Transfer into 32 oz. jar using little or no seawater. Preserve sample in the original jar and formalin solution.

Record Keeping
Fill out the Egg Notebook provided with cruise number, station number, egg sub-sample count, and estimated egg number per jar.

RCOUNTE (cont'd)

Miscellaneous
It is a good idea to provide some sort of air ventilation when handling the formalin. Wipe counters down with a sponge after sub-sampling. Rinse Stempel pipette with fresh water when each sub-sampling session is complete.

BRAIN (Brain Tissue From Larvae / by special request only)

Larval pollock brain cells collected at sea for RNA/DNA analysis.

L-BIOCH (Larval Biochemistry / by special request only)

Larval pollock collected for RNA/DNA analysis. These samples are not collected on a regular basis and are considered by special request only.

Preparation

Have a series of sequentially numbered 1.5 ml microcentrifuge tubes labelled and ready for use in the blue freezer block available in the -80° C freezer. Make sure that a white freezer box is labelled and ready for sample storage in the freezer.

Collection/Preservation

Larvae for this analysis must be alive and wiggling so a time restriction is not a major concern here. Place larvae in a dish of chilled seawater until the desired sample size is established, usually ten per station. Measure larval standard length at 12X magnification and record measurement with tube # in the measurement section in the back of the Green Larval Notebook. Gently pick up larva with larval forceps, blot against a kimwipe to remove excess moisture, and place in the very bottom of the microcentrifuge tube. Check to see that it is really in the tube and not adhering to the forceps. Place filled tubes in the blue freezer block until all of the larvae have been measured and "tubed". Take the blue freezer block and samples to the -80°C freezer and quickly transfer them to their labelled box. Remember to place the freezer block back in the -80°C freezer to be refrozen and used for future samples. Make sure that the lid is secure (a rubber band usually works well) on the filled freezer box and labelled according to year, cruise number, sample type, and owner's name and office phone number if available.

Labelling

Label the microcentrifuge tubes with the cruise and specimen numbers in sequential order. For example, 5mf95-1, 5mf95-2, etc.

Record Keeping

Be sure to keep the Green Larval Notebook updated with the number of larvae preserved and their specimen numbers in the Comments column. Make sure that the SEACAT file for each station/haul is saved.

Miscellaneous

Please remember to rinse the nets and codends thoroughly before starting a quantitative tow (standard 60 cm bongo).

L-GUT (Larval Gut Samples / Instructions for FOCI Gulf of Alaska samples only)

Larval pollock preserved for gut content analysis.

Preparation

You will need a glass scintillation vial 3/4 full of 5% buffered formalin for each station/haul of samples taken. Use larval forceps to transfer the larvae from chilled seawater to the preservative.

Collection

Please follow the procedures for collection for whichever gear type is used. It is important to keep the larvae cold during processing. Generally, it is good to have the samples coordinated with other samples such as L-Musc, histology, etc. that have been taken from live tows. Sample sizes should be at least 10 larvae, but no more than 20 larvae, per station/haul in the area(s) of interest. It is also a good idea to obtain day vs night samples whenever possible.

Labelling

Please use alcohol proof pen for filling out the side labels for the scintillation vials as well as for writing on the caps. On the vial cap, it is important to write the cruise number, station/haul number, and an F for formalin. Label each scintillation vial with a small, peel adhesive FOCI Label on the side of each vial.

Preservation

Larvae should be preserved in buffered 5% formalin in glass scintillation vials.

Record Keeping

Be sure to keep the Green Larval Notebook updated with the number of larvae preserved for gut analysis in the appropriate column for each station/haul (see Miscellaneous section for an example of this). Make sure that the SEACAT file is saved in conjunction with the samples so that the depth/temperature/etc. data will be available for analysis.

L-HIST (Larval Histology)

Live larval pollock collected for histological analysis.

Preparation

Fill a scintillation vial 3/4 full of Z-fix. Z-Fix can be found with the FOCI chemicals. Transfer about 250 ml to a wash bottle that has been used for formalin or Z-Fix (empty chemical wash bottles can be found in the blue tote box with the FOCI chemicals). Label vial cap with station #, haul #, and a Z for preservative type. Use a peel adhesive FOCI label for the side of the vial and make sure that all of the fields are complete. Have sorting trays or bowls ready.

Collection

Larvae are to be collected with the 60 cm bongo with the codends duct taped (see GEAR/Net Tows/Live section). Begin timing the tow when the net is starting up. You have 12 minutes total for towing and preserving. Seven minutes will be used up in towing from depth to deck. Five minutes will then remain for sorting and preserving. Do not rinse down the nets when they return to the deck. Open the codends immediately into clean (live) 5 gallon buckets. Carefully pour the codend contents into a sorting tray or bowl (DO NOT POUR CODEND CONTENTS DIRECTLY ONTO ICE) and remove the larval pollock quickly to accommodate the time restriction (12 minutes from start of net retrieval) using either a pipet or forceps.

Labelling

Please use alcohol proof pen for filling out the side labels for the scintillation vials as well as for writing on the caps. Label each scintillation vial with a small, peel adhesive FOCI label on the side of each vial being sure to fill in all of the fields.

Preservation

It is best to put larvae directly into a scintillation vial of Z-fix as you are sorting to save on time. Remember that preservation of live larvae (wigglers) is best so that a time restriction or tissue degradation is not a problem. Try to get at least 10 - 20 larvae for each station. It is ok to do more than one haul per station (as long as time permits) to make your fish quota.

Record Keeping

Record the number of larvae preserved in the appropriate column in the Green Larval Notebook (see Miscellaneous section for an example). Make sure the vial has been labelled completely with the correct cruise number, haul number, etc. It is important to have the SEACAT file for each tow saved since this will be the only chance at environmental data in situ.

Miscellaneous

Please remember to rinse the nets and the codends thoroughly before starting a quantitative tow (standard survey 60 cm Bongo).

Info. provided by: S. Porter / A. Brown 1-Dec-94

L-MUSC (Larval Pollock Muscle DNA)

Live larval pollock collected for muscle tissue DNA analysis.

Preparation

Label microcentrifuge tubes and place in blue freezer block which is stored in the -80° C freezer when not in use. Place the "loaded" freezer block next to the microscope where the larvae are to be measured. Label a white freezer box with an orange adhesive label which has the year, cruise number, sample type, and sample owner (office phone number if you can). Have a few slides next to the scope for measuring the fish on. Have ready a few pairs of larval forceps and several divided petri dishes of chilled seawater.

Collection

Larvae are to be collected with the 60 cm bongo with the codends duct taped (see GEAR/Net Tows/Live section). Begin timing the tow when the net is starting up. You have 12 minutes total for towing and preserving. Seven minutes will be used up in towing from depth to deck. Five minutes will then remain for sorting and preserving. The timing of the sample is important only if the larvae come up dead. It is best to work with the "wigglers" so that a time restriction is not a problem. Do not rinse down the nets when they return to the deck. Open the codends immediately into clean (live) 5 gallon buckets. Carefully pour the codend contents into a sorting tray or bowl and remove the larval pollock quickly using either a pipet or forceps. DO NOT POUR CODEND CONTENTS DIRECTLY ONTO ICE. Measure standard length of each pollock larvae and place each larvae in its own microcentrifuge tube in the blue freezer block for freezing after all of the fish have been measured from each haul. Record the fish lengths in the back of the Green Larval Notebook in units (be sure to note magnification) and come back when time permits and convert units to mm. Try to get at least 10 - 20 larvae for each station.

Labelling

Go to the back of the Green Larval Notebook and confirm what the larvae identification numbers will be before labelling microcentrifuge tubes. For the first few hauls of L-Musc samples from 5MF95 for example, the tube numbers will be 5MF95-01, 5MF95-02, etc.

Preservation

After the larvae have been measured, quickly transfer the sample tubes to the properly labelled freezer box in the -80° C freezer. After the first station of larvae have been done, it is important that their box remain in the freezer. The blue freezer block should also be returned to the -80° C freezer after samples have been transferred.

L-MUSC (cont'd)

Record Keeping

Be sure to keep the Green Larval Notebook updated with the number of larvae preserved and their specimen numbers in the Comments column. Make sure that the SEACAT file for each haul is saved.

Miscellaneous

Please remember to rinse the nets and codends thoroughly before starting a quantitative tow (standard 60 cm bongo).

L-OTO (Larval Otoliths)

Larval pollock collected for otolith analysis.

Preparation

Have chilled seawater ready to sort codend contents in. Plan on keeping a container of seawater (filtered or unfiltered is fine) in the refrigerator for this purpose. You will need the following equipment to sort and process these samples:

larval forceps
glass or plastic pipets with the tips cut off
white bowls or pans for sorting
ice-bed to put under sorting bowl/pan
ice-bed for petri dish
scintillation vials
labels for outside of vials
alcohol proof pen
buffered 95% ethanol
petri dishes (quadrant dish works best)

Collection

Otolith samples of larval pollock may be taken from the rough count obtained from a 60 cm bongo, Live Tow, or other gear specified by the Chief Scientist &/or the sample requester. Pour the sample into a bowl or tray of chilled seawater for sorting out larval pollock. **DO NOT POUR SAMPLE DIRECTLY ONTO AN ICE BED...THE LARVAE WILL GET STUCK.** Quickly pick out the larvae using larval forceps or a pipet depending on which works best for you and place the larvae in a petri dish of chill seawater for identification and preservation. Make sure you use the small ice-bed under the petri dish while sorting. Preserve 20 - 30 larvae per station for otoliths.

Labelling

Please use alcohol proof pen for filling out the side labels for the scintillation vials as well as for writing on the caps. Label each scintillation vial with a small, peel adhesive FOCI label on the side of each vial. Using an alcohol proof pen, please write the cruise#, station#, haul#, and preservation type (E for ethanol) on the caps of the scintillation vials.

Preservation

Preserve larval pollock in buffered 95% ethanol in a labelled 20 ml scintillation vial for each station/haul.

Record Keeping

The SEACAT file is to be saved in conjunction with the samples so that the depth/temperature/etc. data will be available for analysis. It is also important that the Green Larval Notebook is filled out as to station#, haul#, #larvae in 95% ethanol, grid location, etc.

Info. provided by: A. Brown

10-Aug-97

MERIST (Meristic Study / by special request only)

Special request samples of larvae and/or juvenile fish to examine the formation of meristic features such as fin spines and rays, vertebrae, and/or the ossification sequence of other bony structures.

Preparation

Larval preservation will require buffered 5% formalin and juveniles will be preserved in buffered 10% formalin. Have these solutions on hand as well as the following equipment:

scintillation vials for larvae
32 oz jars for juveniles
water proof labels and India ink pen for inside containers
forceps

Collection / Preservation / Labelling

Samples will be collected throughout the entire sampling season from the first larval cruise through the juvenile cruise. For larvae, samples may be taken from the rough count side (net#2) of the bongo net and measured. For all collections, only two fish of the designated taxon will be placed in each vial or jar. Two measured larvae in 1 mm length intervals (6,7,8,...20) from hatch to 20 mm, will be placed in a vial filled with 5% buffered formalin. The label in the vial should have cruise, station, haul, taxon name, gear, net, date, and lengths of the two larvae clearly written with India ink and not pencil. For juveniles, samples will be preserved as quickly as possible from the codend of the Methot, Anchovy, or other trawl gear. Two fish within 5 mm intervals (20 - 25, 25 - 30, ...75 - 80) will be placed in large vials or quart jars of buffered 10% formalin with a label providing the same information described above for the larvae. Samples should be stored on the ship in boxes with the taxon name and "OSTEOLOGICAL STUDY" clearly written on the outside.

Record Keeping

A log book will be provided by the sample requester to record fish id. and measurements. If the codend that larvae or juveniles are removed from is to be kept and preserved, then put a label in the preservation jar stating what was removed from the sample and how many.

Miscellaneous

The most important aspect of this sampling is proper preservation of the sample which is always 5% buffered formalin for larvae (hatch - 20.0 mm) and 10% buffered formalin for juveniles (SL > 20.0 mm). Unbuffered or improperly buffered formalin is acidic and destroys the calcium matrix of forming bone so particular attention must be paid to this factor.

PRED (Larval Pollock Predator Collections)

Collections of vertebrate and invertebrate predators of eggs or larval walleye pollock for immunoassay. Collections can be made at any time of the day, preferably in areas of high egg or larval abundance as determined by bongo grid survey.

Preparation

Approximately 100 microcentrifuge tubes should be numbered for each tow (see Labelling section). Samples will be sorted over ice, so make sure there are sorting trays with seawater in the blast freezer. Locate Green Predator Log Book, forceps, stopwatch, test tube rack, freezer box, and pipettes.

Collection

Collections are made using the 1 meter Tucker trawl (TUCK1) with 500 um nets and 1.5 mm soft codends. In some cases, a Tucker sled (epibenthic sled) or Methot trawl with a 1.5 mm codend may be used to collect predators instead of the Tucker trawl. The Methot trawl should be fished oblique from 250 meters or within 5 meters of the bottom.

Guidelines for GOA sampling:

<u>For eggs and yolk-sac larvae sampling:</u>
Both TUCK1 nets should have a modified 10" Clarke-Bumpus (LG-CB) net with a flowmeter attached within the center of the Tucker net to collect egg abundance data. Flowmeter data for the TUCK1 will be supplied by the LG-CB.

Sampling Strategy:

Bottom depth > 250 meters	Bottom depth <250 meters
Net 1 from 250 - 150 meters	Net 1 from 10 m off bottom - 150 meters
Net 2 from 150 meters - surface	Net 2 from 150 meters - surface

Once on board, nets 1 and 2 from the TUCK1 should be quickly washed down and the codends brought into the wet lab for sorting. Record the flowmeter readings from the LG-CB and wash down the nets after samples are processed.

<u>For larval sampling:</u>
Use the LG-CB to only record flowmeter data unless specific requests are made for codend collections.

Sampling Strategy:

Net 1 from 100 - 60 meters
Net 2 from 60 meters - surface

PRED (cont'd)

Remove codends from both nets as soon as the nets are on the deck and bring into the lab for sorting. **All predators should be placed in microcentrifuge tubes within 10 minutes after the codend comes on deck.**

Processing:
At least two people are needed to ensure timely processing of the samples and accurate recording of the data in the lab. One person will pick the samples and the other person will record the taxa and vial number in the log book. Net 2 should be sorted first by gently rinsing the contents into a tray with iced seawater on the bottom. Up to 10 large predators from each of the major predator taxa (i.e. euphausiids, hyperiid amphipods, gammarid amphipods, mysids, and chaetognaths) should be removed using larval forceps or pipettes and placed into individually numbered microcentrifuge tubes. Repeat this process for net 1.

Labelling
Microcentrifuge tubes are numbered in sequential order with 001 being the first sample of the field season. Check the Green Predator Log Book for the last number.

Preservation
The microcentrifuge tubes should be placed in a labelled white freezer box and put in the - 80 °C freezer as quickly as possible. Preserve the remaining (non-frozen) part of the sample from each net in 5% formalin using 32 oz jars. Preserve the contents of the Clarke-Bumpus nets in 5% formalin using 8 oz jars.

Record Keeping
The tow, net, microcentrifuge numbers, and major predator categories should be recorded in the Green Predator Log Book. Please note the station, haul, net number and depth fished for each net and any problems in the log book. Separate station collections with a bold line.

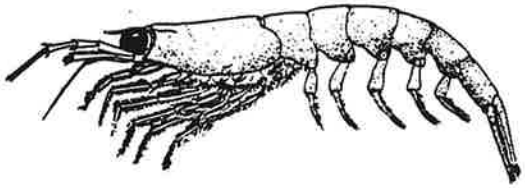
Miscellaneous
The next page has a table and figures that may be useful during predator sorting.

Photo Credits:
Euphausiid, Mysid, Chaetognath, Hyperiid Amphipod from: Newell, G. E. , R. C. Newell. 1963. Marine Plankton A Practical Guide. Hutchinson Educational Ltd., London, 207 p.

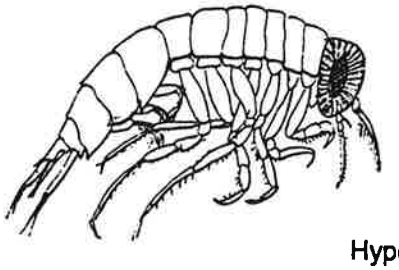
Gammarid Amphipod from: R. I. Smith, J. T. Carlton (editors), Light's Manual: Intertidal Invertebrates of the Central California Coast, 3 rd edition. Univ. California Press, Berkeley, 716 p.

PRED (cont'd)

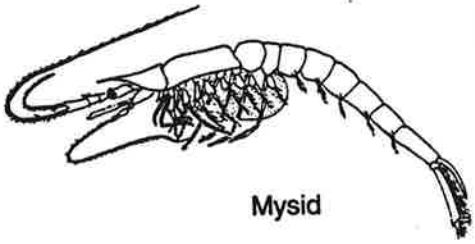
Predator Type	Species	Identifying Characteristics
Hyperiid amphipod	*Themisto pacifica*	*compound eye and purplish exoskeleton *large gnathopods (claws)
Hyperiid amphipod	*Primno macropa*	*compound eye and creamy white exoskeleton *large, spiked gnathopods (claws)
Gammarid amphipod	*Cyphocaris challengeri*	*creamy/whitish to yellowish exoskeleton *usually longer than wide *sometimes has dark orange line on dorsal side
Gammarid amphipod	*Anonyx* spp.	*large amphipod--about 2 to 3 times larger than other amphipods *white exoskeleton and pink eyes *usually in epibenthic layer
Euphausiid	*Thysanoessa* spp. or *Euphausia* spp.	*shrimp-like appearance *thoracic segments covered and fused with carapace *eyes are stalked
Mysidacea	*Meterythrops* spp.	*shrimp-like *red spot behind eyes



Euphausiid

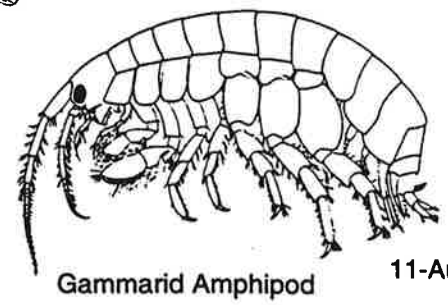


Hyperiid Amphipod



Mysid

Chaetognath



Gammarid Amphipod

Info. provided by: R. Brodeur/ A. Brown

11-Aug-98

QTOWF (Quantitative Tow Preserved In Formalin)

A quantitative tow for eggs, larvae, or other preserved in 5% formalin.

Preparation

Prelabel jar(s) for preservation of codend contents.

Collection

Gears and mesh sizes will vary.

Labelling

Use the water proof Inside Jar labels for the inside of the jars which can be filled out in pencil. For outside labelling, use the self adhesive FOCI labels (USE PEN!). Remember to label the side of each box with the cruise, gear type, preservative, and box number.

Preservation

Rinse codend contents into sieve to reduce the amount of seawater before preservation. Using a wash bottle filled with seawater, rinse the sieve contents into a labelled 32 oz jar. Add 50 ml of formaldehyde and 20 ml sodium borate to the 32 oz jar and add more seawater to fill jar to within 1/4" of lip (**shoulder of jar**). Add 12.5 ml of formaldehyde and 5 ml sodium borate for the 8 oz jar. Screw cap on tightly and turn the jar end over end to mix sample and formalin thoroughly. Place jar in appropriate box.

RCOUNTL (Rough Count)

A rough estimate of abundance obtained while at sea. The following is for a larval rough count.

Preparation

Locate the following equipment for sub-sampling:

4 liter plastic beaker
variety of smaller volume beakers for sub-sampling
larval forceps
pipets (glass or plastic)
white bowls or pans for sorting
ice bed to put under sorting bowl/pan
chilled and filtered seawater for raising sample volume
scintillation vials
labels (for outside of vials only)
alcohol proof pen
dissecting microscope for identification of larvae

Collection

Empty codend into plastic 4 liter beaker and raise the volume of seawater/plankton to a convenient level (usually to 2000 ml since it is easy to identify on the beaker but the thickness of the plankton will often determine this for you).

Gently stir the plankton such that the larvae are well mixed from top to bottom in the beaker. While the plankton is still moving, use a smaller plastic beaker and dip out a 10% sub-sample (for example: from a total of 2000 ml you should take out 200 ml) all at once. The rough count calculation is:

2000 ml/200 ml X # of larvae= rough count

Pour out the sub-sample into a bowl or sorting tray that is sitting on an ice bed. **DO NOT POUR DIRECTLY ONTO AN ICE BED. CHILLED SEAWATER IS GOOD ENOUGH.** Quickly pick out the larval pollock using the larval forceps or a pipet depending on which works best for you and place them in a petri dish of chilled seawater for identification and preservation (if requested).

Labelling

If larvae from the rough count are to be saved, then follow the labelling procedures for the sample type requested. For example, see L-OTO in SAMPLING/Larval section for instructions on labelling vials for otolith samples.

RCOUNTL (cont'd)

Preservation

If a request has been made that the rough count codend is to be preserved in formalin for quantitative analysis, then the pollock larvae from the rough count may still be preserved for a requested sample type. Put a label in the formalin jar with the plankton stating how many larvae have been preserved elsewhere for analysis. Make sure all of the plankton from the sub-sample is also put in the jar.

When preserving larvae for otolith analysis

If there are about 40 larvae removed from the sub-sample, then preserve most of them in 95% buffered ethanol and put 10 - 20 in 5% formalin for gut analysis. Usually it is good to have 20 - 30 larvae per station for otolith analysis but this is not often possible if the larvae are coming just from the sub-sample. If you are willing and time permits, then please feel free to pick some more larvae from the large sample and put them in a separate scintillation vial labelling them as the second sorting. Add this new number (say 20 from the rough count and 10 from the rest of the sample = 20 + 10) to the column of the ethanol preserved larvae. Please use the plus sign to indicate the new larvae and remember that the new larvae are not to be added to the rough count number column in the Green Larval Notebook.

Record Keeping

Fill in the Green Larval Notebook with the rough count, number of pollock larvae preserved in each preservative, station number, grid number, etc. See **MISCELLANEOUS** section for an example of how to fill out the Green Larval Notebook. Also see the **MISCELLANEOUS** section for the equation to convert RCOUNTL to #larvae/10m^2.

Miscellaneous

If discarding of an unwanted plankton sample over the side of the ship, then take care not to splash the windows or deck equipment. Make sure that the codend is rinsed thoroughly before starting the next tow. Rinse all of the sorting equipment.

SHRINK (Shrinkage Experiments / by special request only)

Larval pollock collected and preserved in 95% ethanol, 5% formalin, or frozen for examination of standard length shrinkage due to preservation type.

J-GENET (Juvenile Pollock Genetic Samples)

Juvenile pollock collected for genetic studies. These samples are collected by special request only and instructions will be provided when needed.

J-GUT (Juvenile Pollock Gut Samples)

Juvenile pollock preserved for gut content analysis. These samples are collected by special request only and instructions will be provided when needed.

J-LENGTH (Juvenile Pollock Length Measurements)

Juvenile pollock that are measured for length / frequency analysis. These samples are collected by special request only and instructions will be provided when needed.

J-OTO (Juvenile Pollock Otoliths)

Juvenile (age-0) pollock collected for otolith analysis.

Preparation

Have a supply of specimen labels, freezer bags, and 32 oz jars ready to use. The 95% ethanol has already been buffered in the 20 liter carboy and is ready for use.

Collection

Juvenile pollock may be collected from any of the trawl types (this will be decided by the Chief Scientist at the time). Samples should be randomly selected. Select 20 - 50 fish per station if possible.

Labelling

Make sure samples are labelled with the station number, date, cruise number, haul number, and location both on the inside and outside of sample container (jar or bag). Use the specimen labels for the inside of the preservation containers and the peel adhesive FOCI labels for the outside labelling.

Preservation

Juvenile pollock may be preserved in buffered 95% ethanol in liter jars or they may be frozen in plastic bags. Remember to place a specimen label in each bag or jar for each group of fish preserved.

Record Keeping

Place all requested forms (except DSDB) for each haul in the Juvenile Cruise Binder that will be provided by the Chief Scientist.

J-WGHT (Weights Collected For Juvenile Pollock)

Weights collected for juvenile pollock. These samples are collected by special request only and instructions will be provided when needed.

MERIST (Meristic Study / by special request only)

Special request samples of larvae and/or juvenile fish to examine the formation of meristic features such as fin spines and rays, vertebrae, and/or the ossification sequence of other bony structures.

Preparation

Larval preservation will require buffered 5% formalin and juveniles will be preserved in buffered 10% formalin. Have these solutions on hand as well as the following equipment:

scintillation vials for larvae
quart jars for juveniles
water proof labels and India ink pen for inside containers
forceps

Collection / Preservation/Labelling

Samples will be collected throughout the entire sampling season from the first larval cruise through the juvenile cruise. For larvae, samples may be taken from the rough count side (net#2) of the bongo net and measured. For all collections, only two fish of the designated taxon will be placed in each vial or jar. Two measured larvae in 1 mm length intervals (6,7,8,...20) from hatch to 20 mm, will be placed in a vial filled with 5% buffered formalin. The label in the vial should have cruise, station, haul, taxon name, gear, net, date, and lengths of the two larvae clearly written with India ink and not pencil. For juveniles, samples will be preserved as quickly as possible from the codend of the Methot, Anchovy, or other trawl gear. Two fish within 5 mm intervals (20 - 25, 25 - 30, ...75 - 80) will be placed in large vials or 32 oz jars of buffered 10% formalin with a label providing the same information described above for the larvae. Samples should be stored on the ship in boxes with the taxon name and "OSTEOLOGICAL STUDY" clearly written on the outside.

Record Keeping

A log book will be provided by the sample requester to record fish id. and measurements. If the codend that larvae or juveniles are removed from is to be kept and preserved, then put a label in the preservation jar stating what was removed from the sample and how many.

Miscellaneous

The most important aspect of this sampling is proper preservation of the sample which is always 5% buffered formalin for larvae (hatch - 20.0 mm) and 10% buffered formalin for juveniles (SL > 20.0 mm). Unbuffered or improperly buffered formalin is acidic and destroys the calcium matrix of forming bone so particular attention must be paid to this factor.

QTOWF (Quantitative Tow Preserved In Formalin)

A quantitative tow for eggs, larvae, or other preserved in 5% formalin.

Preparation

Prelabel jar(s) for preservation of codend contents.

Collection

Gears and mesh sizes will vary.

Labelling

Use the water proof Inside Jar labels for the inside of the jars which can be filled out in pencil. For outside labelling, use the self adhesive FOCI labels (USE PEN!). Remember to label the side of each box with the cruise, gear type, preservative, and box number.

Preservation

Rinse codend contents into sieve to reduce the amount of seawater before preservation. Using a wash bottle filled with seawater, rinse the sieve contents into a labelled 32 oz jar. Add 50 ml of formaldehyde and 20 ml sodium borate to the 32 oz jar and add more seawater to fill jar to within 1/4" of lip (**shoulder of jar**). Add 12.5 ml of formaldehyde and 5 ml sodium borate for the 8 oz jar. Screw cap on tightly and turn the jar end over end to mix sample and formalin thoroughly. Place jar in appropriate box.

ROUGH COUNT

A rough estimate of abundance obtained at sea. The following instructions are for a juvenile pollock rough count.

Collection

Gear and mesh size will vary. Count all individuals if less than 200. If more, then randomly sub-sample about 200 juveniles and count and weigh them. Weigh the remaining portion of the juveniles and use the following formula to calculate total catch:

$$\text{Total \# Caught} = \frac{\text{sub-sample \#}}{\text{sub-sample weight}} \times \text{Total Sample Weight}$$

* Total sample weight = sub-sample weight + fish weight not sub-sampled

Divide by the tow duration and multiply by 10 to give a rough estimate of fish number per 10 minute tow. Make sure weight units are consistent (do not mix grams and pounds without converting to a common unit).

Preservation

Preservation will vary upon requested sample type.

Record Keeping

Fill out a Catch form and record rough count in Green Juvenile Notebook.

A-GENET (Adult Genetic Tissue / by special request only)

Tissue samples frozen for genetic study of adult pollock stocks.

A-GUT (Adult Stomachs For Gut Content Analysis)

Collection of adult fish stomachs from potential predators of pollock eggs. These samples will be taken by special request.

Collection

A random subsample of all age classes of walleye pollock and other dominant pelagic predators (e.g. eulachon, arrowtooth flounder) should be set aside from either the bottom tows (Shrimp or Nor'eastern) or midwater tows (Diamond, Rope, Marinovich, Shrimp, or Anchovy) as the tows are being processed for other studies. It is preferred that fish that are already weighed, sexed, and measured be used in this study. Those chosen for stomach analysis should be taken at random from the available fish and should be examined for signs of regurgitation in the oral cavity (extruded stomach or food particles present). Those showing no evidence of regurgitation may be sampled. A fish to be sampled should be placed on a clean board so that any stomach contents which fall out of the stomach during removal can be placed in the bag with the stomach. Each stomach should be excised from as close to the esophagus as possible to the pylorus, and placed in a small stomach bag with a completed stomach bag tag as to cruise, station, and consecutive specimen number. Also fill out a Specimen Label and put it inside the stomach bag. Specimen numbers should also be written on the Specimen Form in a separate column marked stomach number. A minimum of 20 stomachs per species per haul should be taken but more may be required depending on the study. Pollock should be given the first priority. Smaller fish, such as eulachon or other smelt, can be preserved whole in a large stomach bag after first slitting open the side of the fish to allow formalin penetration. Up to 10 fish can be put together in the same bag.

Labelling

The buckets should be labelled on the top and side with cruise number, hauls, species contained in the bucket, and the sample requestors name. Seal each bucket with an uncut lid.

Preservation

The stomach bags should be tied securely and then immersed in a bucket containing 10% formalin/seawater solution. One full 32 oz jar of formaldehyde per 5 gallon bucket should be sufficient. Try not to put more than 100 stomachs in each bucket in order to allow sufficient preservation.

Record Keeping

The Bridge should provide a Haul Position Form for the trawl. Fill out a Specimen Form with the ID number, length, weight, and sex for each tow. If the stomach work is done as a piggy-back study during another project's cruise, please get copies of the Haul Position Forms and any trawl catch information before leaving the vessel.

A-GUT (cont'd)

Miscellaneous

If possible, try to make the stomach collections within an hour of when the trawl is on deck to minimize digestion of contents.

Similar methods should be used for stomach collections of predators of juvenile pollock. In some cases, stomach scans may be done instead of collecting and preserving stomachs at sea. Standard forms are available for noting fullness, condition, and type and volume of contents in each stomach. Special training may be required in the identification of prey organisms.

A-LENGTH (Adult Pollock Length Measurements)

Adult pollock that are measured for length / frequency analysis. These samples are collected by special request only and instructions will be provided when needed.

A-OTO (Otoliths Collected From Adult Pollock)

The collection of otoliths from adult pollock. These samples are collected by special request only and instructions will be provided when needed.

A-WGHT (Weights Collected From Adult Pollock)

Weights collected from adult pollock. These samples are collected by special request only and instructions will be provided when needed.

BLOOD (Blood Collection / by special request only)

Blood collection from adult female walleye pollock to test for maturity condition.

Preparation

Fill a sink or deep tub with cold seawater to serve as a live tank for adult female pollock. Have several Pollock Maturity Study Forms available for recording all requested data. You will also need the following:

sharps disposal containers
heparinized syringes
glass and plastic transfer pipettes
microcentrifuge tubes
sharpies
microcentrifuge tube holders
freezer boxes
scalpel blades and holder
pipette bulbs
small centrifuge (make sure it is properly secured before use)
heparin

To heparinize a syringe, add 10 ml of deionized distilled water to one vial of 100,000 units of heparin. Mix well. Fill each syringe with the heparin solution and then expel it back into the vial. You should be able to prepare at least 100 syringes per vial of heparin.

Collection/Preservation

Ideally, you want two people for this process; one person to do all the sample recording and one person to do the dissections and blood drawing.

Select 10 - 15 fish in the appropriate size range (specified by the sample requester) for the study. Try to get fish that are still alive; if they are all dead, then pick the best looking fish. Immediately transfer these fish to a live tank to slow down enzymatic degradation of tissues and plasma.

Assign each fish a specimen number and record fork length (cm) and body weight (g) of sampled fish. Note whether the fish was dead or alive when sampled. Record this on the Pollock Maturity Study Form. Record maturity stage (see page 3 for stages) and sex of fish also.

BLOOD (cont'd)

Place a heparinized needle/syringe (labeled on the outside with specimen number) into the caudal vein and extract a blood sample. One 1.5 ml microcentrifuge tube's worth is sufficient. Use a new syringe for every blood sample drawn. It is crucial to keep track of the fish number and to label the outside of the syringe in the same manner. Make sure a new needle/syringe is used for each fish. Place the samples on ice until centrifuging.

Remove and weigh the liver and ovaries. Record weight in grams onto the Pollock Maturity Study Form.

Bring blood samples into the lab and expel samples into labeled microcentrifuge tubes. Place the tubes in the centrifuge (try to do this when the boat is not moving too much) and spin down the blood samples for 10 minutes at 2000 rpm. When the spin cycle is complete, the blood clot will have pelleted to the bottom. The supernatant, or plasma, which may range in color from pale yellow to pinkish will form above the clot. Use a new pipette for each specimen and draw off the top layer. The tube will usually contain less than 1 ml of supernatant. Transfer this into a new, clean, and labeled microcentrifuge tube. Keep the numbering scheme consistent throughout the sampling. Place the plasma samples in the -80°C freezer in a freezer box. Label the box lid with the year, cruise number, owners name and phone number, and the specimen numbers (e.g. 95-001,etc.).

Record Keeping
A Pollock Maturity Study Form and a DSDB should be filled out.

BLOOD (cont'd)

Below is the five-point maturity scale to be used to determine the maturity condition of female walleye pollock.

Stage 1 **Immature** Ovaries small, transparent, and tapered.

Stage 2 **Developing** Ovaries tapered, forming two distinct lobes having well developed vascularization. Ovaries may be partially granular (some distinct ova).

Stage 3 **Mature** Ova distinctly visible but cannot be extruded when ovaries are compressed. Ovaries are two large, distinct lobes.

Stage 4 **Spawning** Ova extruded when gonads are compressed or ova are loose in ovarian membrane.

Stage 5 **Spent** Ovaries are large but flaccid and watery. Ovaries may contain remnants of disintegrated ova and associated structures.

OVARY (Ovaries Collected For Fecundity Studies)

The collection of ovaries from adult pollock. These samples are collected by special request only and instructions will be provided when needed.

STRIP (Strip Spawning of Adult Pollock)

Fertilzation of pollock eggs for transport to Seattle for rearing.

Preparation

Set up Cuno filter housing with 5 um filter. Attach garden hose in the Fish Processing Lab (Miller Freeman) to the filter apparatus. You will need the following equipment to process, maintain, and transport the fertilized eggs:

plastic white bowls
large PVC sieve
ladle
flat aquarium net on frame
wash bottle
gallon jars and netted platic lids
red crates
2.5 gal. seawater jugs
long plastic pipettes
1/4" styrofoam
thermoses
coolers
blue ice
duct tape
shipping labels

Collection

Select females which are running ripe or will extrude eggs with gentle pressure. Select males which are leaking milt or will release milt with gentle pressure. Use 1 - 2 males per female, depending upon availability.

Put about 1 liter filtered ambient temperature (temperature of water from Cuno filter / garden hose that has been running for several minutes) seawater into a large white plastic bowl. Extrude a small amount of milt from one male into the bowl and mix gently by hand briefly. Extrude eggs from a female by applying gentle pressure with the base of your thumb. Good eggs are completely translucent and should flow freely from the vent. If you have to apply a lot of pressure, the female is probably not ready and you may contaminate the sample with fecal material. Put eggs from only one female into the bowl at a time. Extrude milt from a different male into the bowl and mix briefly.

Let the eggs and milt sit about 5 - 10 minutes after mixing. Put the large PVC sieve into another large bowl that is filled with filtered seawater and gently ladle surface eggs into the sieve. The best eggs will be in the top 1/2" of water in the bowl so ladle eggs only

STRIP (cont'd)

from the surface. Rinse eggs by gently pouring filtered seawater into the sieve until the bowl is full. Quickly lift sieve out of the bowl, dump rinse water, fill bowl with seawater, put sieve back into bowl, and pour more water over the eggs. Repeat this procedure until the rinse water is clear. Do not leave the eggs exposed to air.

Fill a white bowl with about 1 liter filtered seawater. Transfer eggs into the bowl by backwashing the sieve with a wash bottle filled with filtered seawater. Ladle surface eggs onto a modified aquarium net in order to estimate number; the circle on the small net equals about 500 tightly packed eggs in a single layer. About 1500 eggs should then be transferred with a wash bottle into a gallon jar which has been filled 3/4 full with ambient seawater. Screw on a white plastic lid with screening. Place jars in red crates with 1/4" styrofoam between jars and put in refrigerator. Label the jars with female ident., spawning date, and time.

Maintenance

At least 50% of the seawater should be changed every day with prechilled seawater (kept in refrigerator in 2.5 gal. jugs). Pour water through the screening; there is no need to remove the lids except to remove dead eggs (a dead egg is white and sinks to the bottom of the jar). Remove dead eggs with clean pipette (long plastic ones) daily.

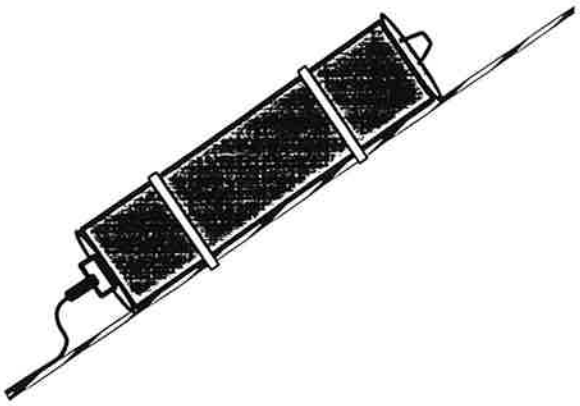
Transportation

To ship eggs back to Seattle, fill each thermos about 3/4 full of filtered seawater and chill overnight. Put blue ice in freezer overnight. Gently pour eggs from gallon jars onto small aquarium net with black circle on it. This circle equals 500 eggs in one layer, so eyeball as best as you can. It is best to transport only 500 - 1000 eggs per thermos. Top off thermos with filtered seawater (leaving about 1" of air space) and cap. Put as many blue ice packages into each cooler as possible (at least 4 in small cooler, 6 in large cooler). Place a completed shipping label inside each cooler. Tape coolers shut with duct tape and label outside of cooler.

CAT (Data Collected From A SEACAT CTD)

A SeaBird SEACAT CTD is used to measure conductivity, temperature, and depth in the water column. Instructions regarding collection of this data are not included at this time. Operation of this instrument is done by PMEL and the Survey Department.

EBKG (Electronic Bathykymograph)



The EBKG was developed for to provide a real time depth readout for plankton tows. Temperature is also recorded, but the sensor on the unit is not capable of responding properly at the speeds we operate.

Assembly

There is a green, wooden suitcase that contains the BKG probe and deck units needed for operation. There should be a manual inside the case or in Dataplot that gives instructions on setup and operations. The Survey Tech or Electrician Tech will be required to terminate the probe onto the towing cable.

Rates/Fishing

Readout from the BKG may be viewed in Dataplot (on the Miller Freeman) on a digital display, and also as a computer file recorded on the portable Compaq. Instructions should be with the equipment regarding starting and saving the files. Record in a green notebook the wireout, max depth, and bottom depth for each station the BKG is used. The person in Dataplot monitoring the depth should also give the winch operator instructions over the radio on rates, when to start or stop the winch, and appropriate warnings to avoid problems.

NETFLUOR (Fluorescence Data Collected During A Net Tow)

Fluorescence is measured using a fluorometer attached to the winch cable during a net tow. Instructions regarding collection of this data are not included at this time. Operation of this instrument is done by PMEL and the Survey Department.

SCANMAR

SCANMAR is intended to be used by groundfish scientists to give them depth fished, plus mouth opening characteristics of the fishing trawls. FOCI also uses a part of the SCANMAR equipment attached to our larger net frames (like the Methot trawl) to provide a real time towing depth. The setup and operation of the SCANMAR unit needs to be done by someone trained in it's use. A computer file may be saved.

VIDEONET (Video Camera Attached To A Net Tow)

The use of video cameras is relatively new to FOCI and no set protocol exists at this time. If samples are requested, then appropriate instructions will be given.

ABSORB (Spectral Absorbance Samples Collected From CTD Casts)

Absorbance samples may also be collected from the underway water system.

Preparation

The chlorophyll manifold is required for filtration; if it is not already setup then follow the instructions on the CHLOR page in SAMPLING. Rinse the cups and bases with fresh water before and after filtering to reduce the chance of contamination. Place a Whatman GF/F filter (nominal pore size 0.7 µm) on each of the bases you will be using. Twist cup into place. Label microcentrifuge tubes (see Labelling below).

Collection

The goal is to filter enough water so that color (brown or green) is easily visible on the filter. In clean waters (i.e., low phytoplankton) this will be approximately 1 liter. In dense waters the volume can be as low as 100 ml. It is better to err on the side of filtering too much than not enough. Collect chlorophyll samples (see CHLOR page) whenever an absorbance sample is collected.

CTD

Use a graduated cylinder or calibrated poly bottle (used for chlorophylls) to collect water from the Niskin bottle. Do not dump the Niskin bottles until you are sure you have filtered enough water.

Underway/Surface

These samples require the flow-thru fluorometer to be set up; if it is not, then follow directions on SURFACE CHLOROPHYLL page in SAMPLING. Collect water from the system by opening the screw clamp labelled A (see diagram on SURFACE CHLOROPHYLL page) and allow water to flow. Use graduated cylinder or calibrated poly bottle (used for chlorophylls) to collect the water. Make note of the readout on the front of the fluorometer (labelled E).

When filtering samples, vacuum pressure should be < 5 psi to reduce the chance of particle breakage. Keep a record of the total volume filtered (see RECORD KEEPING section). When finished, use two forceps to remove the filter from the base without touching the forceps to the colored area. Bend the filter in half (color on the inside) being careful not to let the two inner sides touch each other. You just need to bend it enough so that it fits inside a labelled microcentrifuge tube. PLEASE DO NOT CRAM FILTERS INTO THE BOTTOM.

Blanks

Collect four blank filter pads for each new box of GF/F filters used by filtering 100 ml of distilled water (you can ask the Survey Department for distilled water). Place each filter in its own labelled microcentrifuge tube. These samples are used for laboratory calibrations.

ABSORB (cont'd)

Labelling

CTD

Label each tube with its sample number and corresponding volume filtered. The sample number is in the abbreviated form 'xyyyzz' where x is the ship's cruise leg number (i.e., MF95-01 = 1), yyy is the CTD cast number and zz is the depth (leading zeros are important).

Underway/Surface

Label each tube with ship's cruise number, GMT Date, GMT time and total volume filtered.

Blanks

Label each tube with the ship's cruise number, GMT Date and GMT time and the word BLANK.

Preservation

Quickly place samples into the -80 °C freezer in labelled white freezer boxes (cruise and "Absorbance Samples"). It is important that these filters freeze as quickly as possible.

Record Keeping

CTD

Record the sample number in the "Other" column on the CTD cast log form and record volume filtered and station information on the CTD Cast Chlorophyll and/or Absorbance Samples sheets.

Underway/Surface

Record GMT date, GMT time, volume filtered and fluorometer reading (station and haul if on station) on Flow-thru Chlorophyll and/or Absorbance Sampling Log sheets.

Blanks

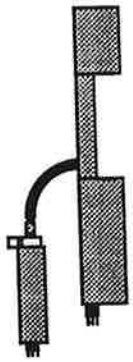
Record GMT date, GMT time and the word BLANK on Flow-thru Chlorophyll and/or Absorbance Sampling Log sheets so that you know they were taken and approximately where they are in the freezer box.

Maintenance

Follow instructions on MAINTENANCE for CHLOR in SAMPLING.

CHLAM (Chlorophyll Absorption Meter Mounted On The CTD/Rosette)

A WET Labs A-3 analog ChlAM is used to measure chlorophyll absorbance (an index of phytoplankton biomass) in the water column. Instructions regarding collection of this data are not included at this time. We are currently refining our protocol and hope to include it in the future.

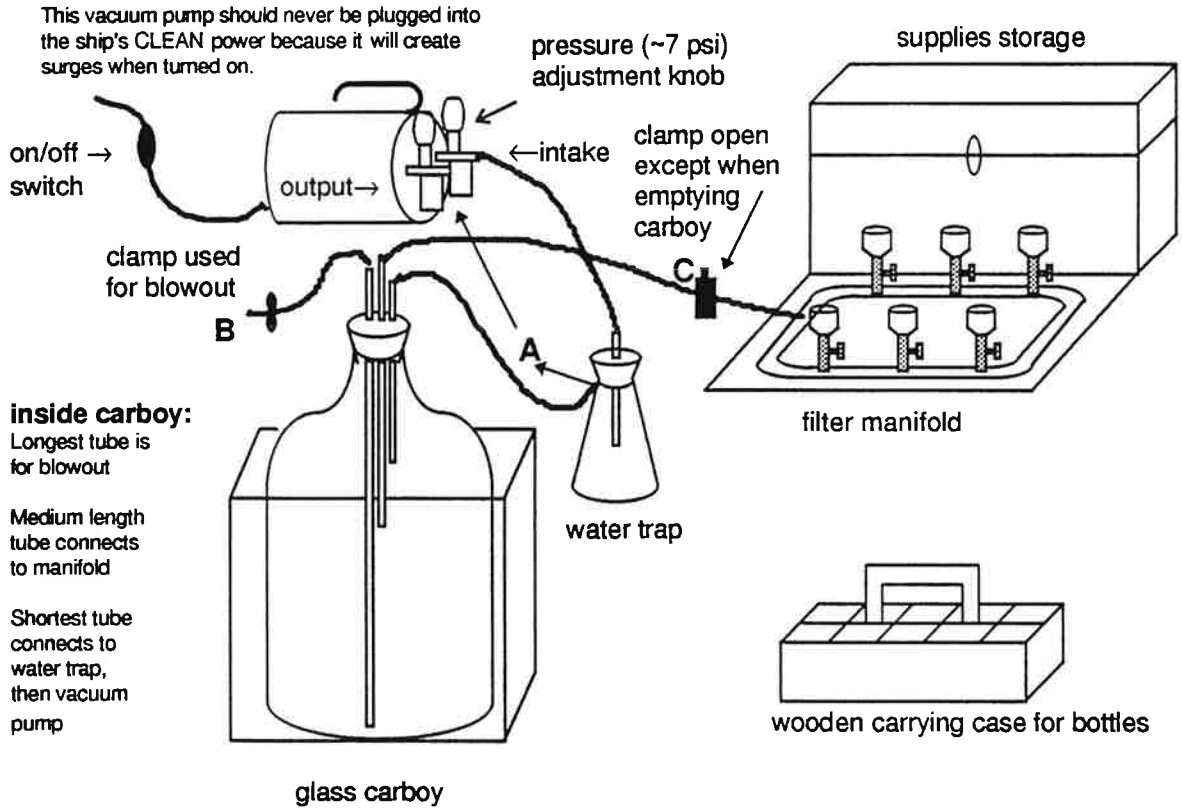


CHLOR (Chlorophyll Samples Collected From A CTD Cast)

Extracted chlorophyll is an index of phytoplankton biomass.

Preparation

Connect apparatus as shown.



Locate small plastic calibrated sample bottles and rinse with fresh water.
Note: There are two sizes of calibrated bottles available for chlorophylls. For early cruises, it is best to start with the larger bottles (~289 ml). If the filters clog and filtration time lengthens, then switch to the smaller bottles (~139 ml). Make sure that you still see some color (green or brown) on the filters after using the smaller sample volume otherwise switch back to large bottles.

Ready filter apparatus by placing a clean 2.4 cm Whatman GF/F filter (there is no difference between sides) on each of the six bases using the Millipore forceps. Rinse filter cups with fresh water and twist into place.

Label microcentrifuge tubes (see Labelling section).

CHLOR (cont'd)

Collection

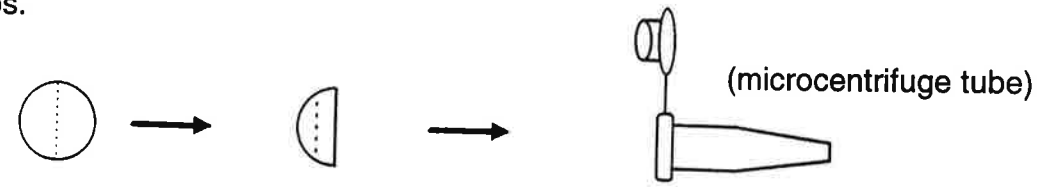
Water is collected on the "upcast" with Niskin bottles at depths determined by the Chief Scientist. Typical casts include the collection of MZ, chlorophyll and nutrients from a single Niskin bottle with chlorophyll and nutrients being sampled first. If this is the case, then procedure is as follows:

On deck, use a fresh water rinsed graduated cylinder to remove 500 ml of seawater from the Niskin bottle. Rinse calibrated sample bottle twice with a small amount of water from the graduated cylinder. Remember that the 500 ml will be used (in most cases) for a chlorophyll and nutrient sample.

Fill bottle to the top (gently tap to remove air bubbles and add more water if necessary) and screw on cap.

Chlorophyll degrades in strong light or heat so if you can't filter the bottles right away, please store them on ice in the dark until you can filter them.

In the lab, gently pour samples into filter cups and filter samples using low vacuum (7 psi). When finished, remove filter cup. Use two forceps to fold filter into fourths with filtered material (color) on the inside, being careful not to touch colored area with the forceps.



Place filter into labelled microcentrifuge tube. **Please do not jam filter into bottom** because they are difficult to remove when frozen. Wrap all samples from a single cast in a sheet of aluminum foil and label the foil (see below).

Labelling

Label each tube with FOCI cruise number, station, haul and depth. **If there are multiple samples taken from the same depth** (separate Niskin bottles or not) **you must record the volume filtered on each microcentrifuge tube.** To calculate chlorophyll concentration you must have volume filtered. Wrap all samples from a single cast together in a sheet of aluminum foil. Please label outside of foil with FOCI cruise number, station, and haul.

CHLOR (cont'd)

Preservation
Place aluminum foil packet into a cruise labelled white freezer box in the -80° C freezer.

Record Keeping
Record station, haul, bottle depth and bottle volume on CTD Cast Chlorophylls and/or Absorbance Samples sheets. Also, please place a check mark in the CHLOR / MZ column on CTD cast log form next to corresponding depths. This information has proved very helpful in the past when questions regarding station numbering arise.

Maintenance
Emptying the carboy:

The water that collects in the large glass carboy will need to be emptied periodically. Water should never reach the level of the shortest tube; if it does then water will be sucked into the vacuum pump. To blow out the carboy, remove the hose that connects the water trap to the vacuum pump (labelled **A**) and connect it to the vacuum pump output . Open the clamp used for blow out (labelled **B**). Close the clamp nearest the filter manifold (labelled **C**). Turn on the vacuum pump. Water should flow out the tubing (the one with clamp **B** on it). Water can be used for MZ samples and stored in white plastic FSW carboy or just poured down the sink. When done, close the clamp **B** and open clamp **C**. Return tubing (labelled **A**) back to the water trap.

Pump:
It the pump provided has an oil reserve (will be located near intake valve) you must make sure that there is oil in the pump. Running an oil pump without oil will cause the pump to seize. Extra pump oil is supplied.

Periodically spray WD-40 inside the pump and allow it to run without vacuum to purge the pumping chamber of any condensable vapors (seawater). To do this you must disconnect the tubing from the intake and outake valves on the pump. Turn the pump on and spray the WD-40 directly into the intake hole and let the pump run for 3 - 5 minutes.

Miscellaneous
If -80°C freezer goes down, please transfer samples to the -20° C freezer. Record on next DSDB form that samples were transferred.

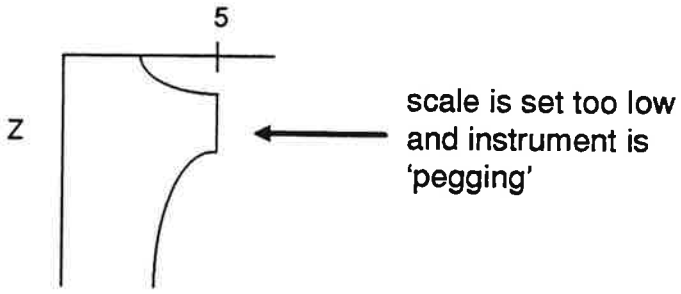
CTD (Data Collected From A CTD Cast)

A SeaBird CTD is used to measure conductivity, temperature, and depth in the water column. Instructions regarding collection of this data are not included at this time. Currently, operation of this instrument is conducted by PMEL and the Survey Department.

FLUOR (Fluorometer Data Collected From A CTD Cast)

Fluorescence is measured using a Sea-Tech fluorometer attached to the CTD/Rosette. Instructions regarding collection of this data are not included at this time. Currently operation of this instrument is conducted by PMEL and the Survey Department.

Biologists on watch should monitor signal (0 - 5 volts) during casts and check to see that signal does not exceed the set range.



If the instrument is 'pegging', then the actual signal exceeds the set range. Ask the Survey Tech or ET to open the instrument and change scales (instructions are in the fluorometer documentation kept by PMEL). Any changes in the instrument settings should be noted on the CTD cast log form corresponding to the first tow on which the new settings were used. The Survey Tech must also change the settings in the SCS file to correspond with those on the instrument.

LUGOLS (Seawater Samples Preserved Using Lugol's)

Lugol's is an acidic, iodine-based preservative used to preserve protozoa in seawater samples.

Gloves should be worn when working with Lugol's. When not being used, Lugol's should be stored under a dark fume hood due to it's photosensitivity.

Preparation

Depending on the sample request and jar type provided, you may be asked to calibrate sample jars before collection (some requests may ask you to eyeball the water level). If asked to calibrate, then see MISCELLANEOUS section for an example.

Collection

Drain water from Niskin bottles directly into the jar up to the "fill" line. Cap and bring into the lab for preservation.

Labelling

Label with a FOCI jar label on the side. Record the depth sampled in the Mesh space on the label. Write LUGOL'S in the margin of the label.

Preservation

Samples are to be preserved in a 2% Lugol's solution. Use "dead" graduated cylinder or syringe (usually kept with Lugol's under the fume hood) to measure the appropriate amount of Lugol's required for the jar size provided. Carefully pour into jar using a funnel if necessary. Gently mix samples and store them in the dark.

<u>for narrow mouth 1 liter bottles:</u>
16 ml of Lugol's added to 800 ml of seawater (this is about 2%)

Record Keeping

Please write LUGOLS in "Other" column of the CTD Cast Log Form corresponding to depth sampled.

LUGOLS (cont'd)

Miscellaneous

Lugol's Recipe

2 g potassium iodide (KI)
1 g iodine
200 ml distilled water
20 ml glacial acetic acid

Dissolve KI in 20 ml of distilled water. Add Iodine and dissolve. Add remaining water and then acetic acid.

Calibrating jars
For 1 liter narrow mouth sample jars, use a graduated cylinder and measure 800 ml of fresh water and pour into the sample jar. Use a Sharpie to draw a line on the outside of the jar at the water level. This is referred to as the "fill" line. Empty jar and store until needed.

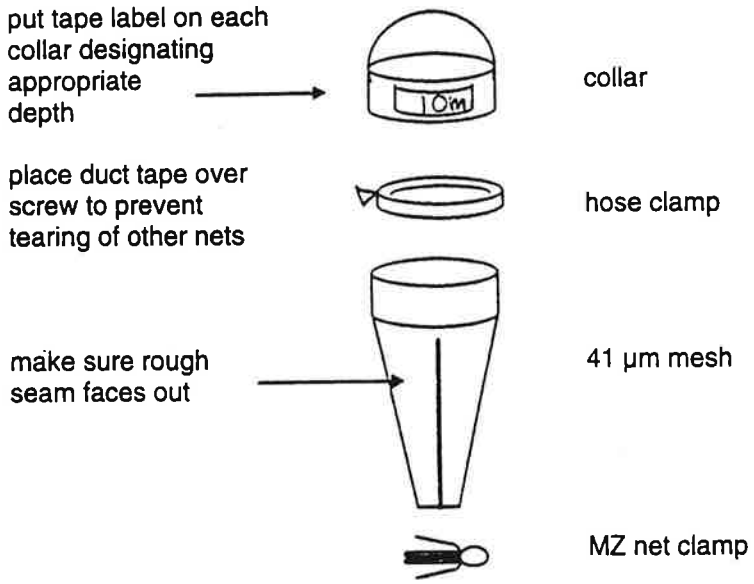
MZ (Microzooplankton Samples Collected From A CTD Cast)

Microzooplankton samples collected to determine prey abundance for larval pollock.

NOTE: Although the original definition of MZ was just for samples collected from CTD casts, we now also consider the sample abbreviation for calvet tows (where microzooplankton collection is the primary goal) to be MZ also. It must be entered this way to allow for easier sample tracking.

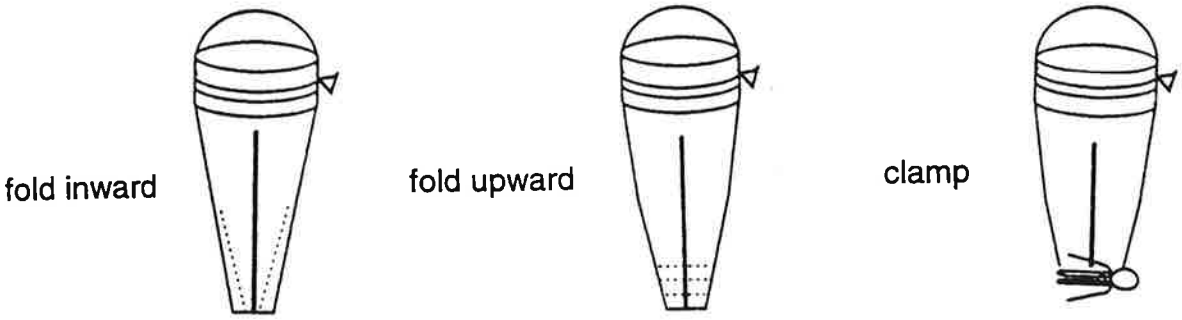
Preparation

First time setup requires the assembly of the pieces shown below.



Put a 6" piece of 3/8" ID silicon tubing on the stopcock of the Niskin bottle for each depth to be sampled. Attach bungi cords to Niskin bottle (around bottle and above stopcock) so as not to interfere with spring, but to be used as a hook to hold net during filtering (see figure in Collection section). Tubing and bungi cords can stay on the Niskin bottles during all CTD casts.

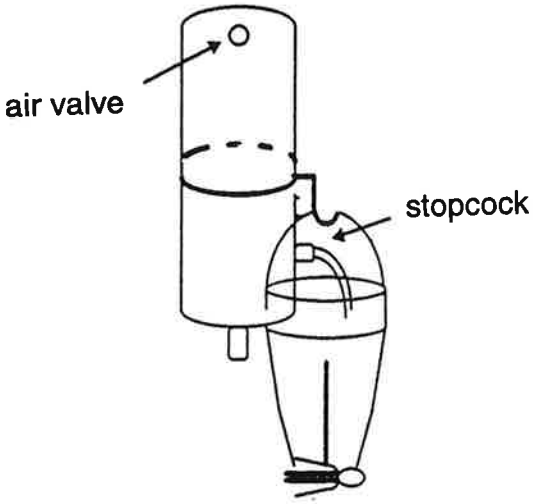
CTD cast preparation:
Before each cast, rinse nets with fresh water and fold as shown.



MZ (cont'd)
Have approximately 2 liters of filtered seawater (FSW) on hand for each cast. Obtain FSW by emptying the glass carboy used for filtering chlorophylls (refer to MAINTENANCE section of the CHLOR page in SAMPLING for directions). If FSW is not available, then prepare some by draining seawater through one of the MZ nets. Fill two squirt bottles with FSW. Prepare labels (see Labelling below).

Collection
Water is collected on the "upcast" with 10 L Niskin bottles at depths determined by Chief Scientist. Typical casts include the collection of MZ, chlorophyll and nutrients from a single Niskin bottle. If this is the case, then procedure is as follows:

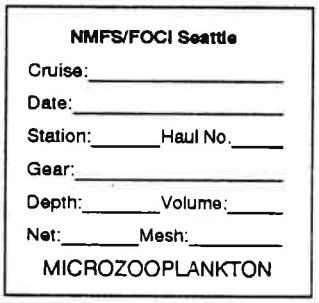
Use a graduated cylinder to remove 500 ml of seawater for chlorophyll and nutrient collection and then attach MZ net to bungi cord and place silicon tubing inside net. Open stopcock and air valve and let Niskin bottle completely drain.



When all bottles have drained, collect nets and bring into lab for immediate preservation.

MZ (cont'd)

Labelling
There should be two identical labels, one on the lid and one on the side of the jar that both contain the following information:


NMFS/FOCI Seattle
Cruise:_____
Date:_____
Station:_____Haul No._____
Gear:_____
Depth:_____Volume:_____
Net:_____Mesh:_____
MICROZOOPLANKTON

Preservation
Preserve MZ samples in **8 oz jars** with filtered (at least down to 41um) seawater and 12.5 ml of formaldehyde (buffered with 5 ml sodium borate).

Place jar into the jar holder in sink. Put large the MZ funnel into jar. Hold net over jar and remove clamp. Gently unfold net and rinse contents into jar with squirt bottle of filtered seawater. NEVER USE SEAWATER FROM SINK WITHOUT FIRST FILTERING.

Record Keeping
Place an "X" in the "CHLOR/MZ" column of the CTD Cast Log Form next to corresponding depth sampled.

NUT (Nutrient Samples Collected From A CTD Cast)

Nutrient samples used to determine if conditions are favorable for phytoplankton growth.

Preparation

Small numbered plastic bottles filled with distilled water (60 ml bottles stored in wooden flats) should be located and set out before the CTD cast begins.

Collection

Collect water from Niskin bottles at depths determined by Chief Scientist.
Typical casts include the collection of MZ, chlorophyll and nutrients from a single Niskin bottle with nutrients and chlorophyll sampled first. If this is the case, then the procedure is as follows:

Use a graduated cylinder to remove 500 ml of seawater. Empty the numbered plastic bottles of their distilled water and rinse two times with the cap on using a small amount of water from the graduated cylinder. Remember that the 500 ml will be used (in most cases) for a chlorophyll and nutrient sample.

Fill the numbered plastic bottle **1/2 to 2/3 full** and screw the cap on tight.
DO NOT OVERFILL BOTTLES !! Water expands as it freezes and will force open the lid resulting in a contaminated sample that is useless.

Keep track of the bottle number used for each Niskin bottle since these numbers will need to be recorded in the lab (see Record Keeping).

Preservation

Place bottle in a blast freezer (-20°C) in an upright position. Try to keep bottles in sequential order. Use the empty wooden carrying case that the bottles came in for storage in the freezer.

Record Keeping

Record each bottle number on the CTD Cast Log Form in the "Nutrient Bottle#" column corresponding to depth sampled. The sample is useless unless depth in known.

Miscellaneous:

If the blast freezer goes down or space becomes limited, then the samples may be kept in any alternate freezer available. Please check with the FOO or Survey Tech first. Record on next DSDB form that the freezer failed and samples were moved.

PAR (Photosynthetically Active Radiation)

Photosynthetically Active Radiation is measured using a light meter attached to the CTD/Rosette. Instructions regarding collection of this data are not included at this time. Currently, operation of this instrument is conducted by PMEL and the Survey Department in conjunction with AFSC.

Miscellaneous

Record PAR in DSDB Rbase application for all times in which it is used. It will be up to the end user to determine whether the data meets specific light criteria.

Maximum depth for this instrument is 1000 meters.

PHYTOF (Phytoplankton Samples From A CTD Cast)

Seawater samples collected from a CTD cast for phytoplankton cell counts.

Preparation

Prepare labels for jars.

Collection

Water is drained directly from a Niskin bottle into a jar. You may want to attach a piece of silicon tubing to the stopcock on the Niskin bottle to direct the water into the jar. Fill the sample jar to the shoulder and complete volume with 25 ml of formaldehyde and 10 ml sodium borate.

Labelling

Use a FOCI label on the top and side of the jar.

Preservation

Preserve sample in a 32 oz jar using 25 ml of formaldehyde and 10 ml sodium borate. Gently turn jar end over end to mix sample.

Record Keeping

Record PHYTOF in "Other" column of CTD Cast Log Form corresponding to depth sampled.

POC (Particulate Organic Carbon Samples Collected From A CTD Cast)

These samples are not requested on a regular basis and hence instructions will be given when needed.

VIDEOCTD (Video Camera Attached To CTD)

The use of a video camera is relatively new to FOCI and no set protocol exists at this time. If samples are requested, then appropriate instructions will be given.

ADCP (Acoustics Doppler Current Profiler)

A vessel mounted Acoustics Doppler Current Profiler collects data continuously while the ship is underway. The ADCP measures the ocean current velocity over a set depth range of the water column. ADCP data may be used to estimate the abundance and distribution of biological scatter over the sampled depth range.

Miscellaneous

Dedicated transects do not contain any stations between the beginning and the ending of the transect.

EK500 (EK500 Data Collected On Dedicated Transects)

The EK500 is used to detect the presence of unusual acoustic signals or heavy fish sign.

The Simrad EK-500 Scientific 38 kHz Echosounding System (Miller Freeman) will be turned on during some scientific operations and should be monitored regularly for the presence of unusual acoustic signals of heavy fish sign. The Bridge should notify the scientific watch on duty if any unusual sign appears on the echosounder. Because of the vast amount of data and paper generated by this system, the PC data-logger and color printer should only be turned on when in an area of interest or when unusual sign begins to show. A trained scientist should be available to begin logging data onto a PC using PROCOMM and to record ship speed and course changes on the traces and file names and log numbers in the notebook provided. Files should be closed after a maximum of two hours and backed up onto 3.5" disks or other storage medium before the end of the cruise. The printer pen cartridges and paper should be replaced as needed. The EK-500 settings will be set at the beginning of the cruise and remain the same throughout the cruise. Because of the complexity of the system, only those scientists who have been trained by acoustic personnel will be allowed to use the EK-500. A DSDB form should be filled out only for dedicated acoustic transects (i.e., do not contain any stations between beginning and ending of the transect).

SSF (Sea Surface Fluorescence)

Seawater from the scientific seachest is pumped (past a TSG sensor) to the Chem Lab and through a Turner Designs continuous flow fluorometer (on the Miller Freeman). The fluorescence values are automatically recorded by the SCS system. The ship's SCS manager is responsible for ensuring that data from the instrument are correctly logged by the SCS. The scientists are responsible for regularly cleaning the cuvette inside the instrument and collecting calibration samples (see SURFACE CHLOROPHYLL section in SAMPLING).

TSG (Thermosalinograph)

A SeaBird thermosalinograph is mounted in the scientific seachest (on the Miller Freeman) and the values are logged by the SCS system. The ship's SCS manager is responsible for ensuring that data from the instrument are correctly logged by the SCS.

ALGAE PROBLEMS

Phaeocystis---greenish-brown, stinks, foams when net hosed down

Phaeocystis has been a continuing problem in the mid-Spring for the Gulf of Alaska and Bering Sea ichthyoplankton surveys. This algae clogs the 333 um mesh of the 60 cm bongo and makes sample preservation a time consuming chore. There has also been some concern expressed about the potential for the loss of larvae and zooplankton when the codend is removed from the net. Since the sample tends to back-up in the net and not settle in the codend completely, there is a tendency for the sample to explode horizontally as soon as the codend collars are separated. This usually results in plankton covered hands and the sample coming dangerously close to being lost over the rim of the 5 gallon bucket that the codend is sitting in to catch any spill over.

Instructions:

1) Assessing The Problem

The more algae clogging the mesh of the net, the darker the color of the net. If the net has passed through a very heavy patch of algae, then it will be brownish and barely draining any seawater as the bongo frame is hanging alongside the sampling platform. When the algae is less abundant, the net will be a light green/brown and will still filter seawater without backing-up the codend contents. Properly assessing the way the algae is affecting the seawater filtration will be the key to making the net rinse-down as quick as possible without compromising the sample quality.

2) Rinse-Down

A complete rinse-down of a heavily clogged bongo net is not worth the time and effort. The 60 cm bongo net (333 um mesh) consists of two net sections, a pvc collar, and the pvc codend. The best plan of attack is to do a quick rinse of the first net section and a thorough rinse-down of the second section. The codend will quickly back-up with the foam released by the algae. Remember that dead larval fish may rise to the top of the sample and get lifted up by the foam. Once the seawater and foam start to rise about a third of the way between the codend collar and the seam of the two net sections, it is much easier to finish the rinse-down without the codend attached to the net. Place the codend in a 5 gallon bucket which has the splash guard attached and slowly remove the codend from the collar. Be prepared for the sample to be forcefully released into the bucket. Leave your now plankton covered hands in the bucket while someone else rinses the sample off of you. Once you are sample free, rinse down the second section of the net into the bucket with the rest of the sample. **Make sure that you rinse off the splash guard into the bucket before it is removed.**

Info. provided by: A. Brown

3-Mar-97

ALGAE PROBLEMS (cont'd)

3) Sieving Sample

Use the 12 inch sieve(s) of the appropriate mesh (most likely the 333 um sieves) for filtering off the extra seawater and foam. Wash off the sides and top of the codend into the bucket before you lift it out to be poured into the sieve(s). Plankton that has spilled into the bucket will have to be filtered through the sieve(s) also. Rinse out the bucket into the sieve(s) so that the bucket looks as clean as possible. There are two sieves available for each mesh size so it is wise to get both of the sieves filtering at the same time when a lot of sample needs to be reduced in a short time. Clear the clogged sieves often by stroking the underside with your fingers to keep things moving. Try not to blast the sieve mesh with seawater to unclog the mesh too often since this may damage the smaller organisms in the sample. Use a squeeze bottle to move the sample from the sieves into the jars for preservation.

4) Preservation

A plankton sample with a large amount of algae may require several 32 oz jars for preservation. Fill each jar a third of the way full with sample and top it off with seawater and 50 ml of formaldehyde and 20 ml sodium borate. Make sure you mix the jar contents thoroughly by turning the jar end over end several times before placing it in the appropriate box. Continue to split up the sample in this way until all of it is preserved.

Reattach the clean codends to the bongo nets only after both sections of the net are thoroughly rinsed out and inspected for trapped algae in the seams. While on deck, rinse out the buckets used for carrying the codends/samples before the next station to insure that there is no contamination from the last sample.

ALGAE PROBLEMS (cont'd)

Chaetoceros---brown, spiny algae, packs down in codend like peat moss

Chaetoceros may be encountered in the Spring in either the Bering Sea or the Gulf of Alaska. This type of algae is not difficult to rinse from the nets, but it may damage the more delicate organisms in the sample. *Chaetoceros* does not foam when it is being rinsed with seawater but it does settle down into the codend as a dense mass of material similar to peat moss.

Instructions:

1) Rinse-Down

Rinsing down of a 333 um or 505 um bongo net will not be a problem with this algae. Try not to blast the net too hard or for any longer than necessary. It is ok if some of the algae is left in the seams of the net as long as you remember to give the net a very thorough cleaning before the codend is reattached.

2) Sieving Sample

Pour the codend contents into the 12 inch sieve(s) of the appropriate mesh. Chances are that extra seawater will not be a problem with this algae since it filters well. Do not try to blast the sample with seawater in hopes of getting rid of some of the algae since you will only damage the larvae and zooplankton further by forcing algae through the sieve mesh. Use a squeeze bottle to move the sample out of the sieve for preservation.

3) Preservation

Preservation of this type of sample requires some extra thought as well as extra jars. Since the sample will be thick and heavy, it will require many 32 oz jars to preserve it properly. Fill each jar a third of the way with sample and top off with seawater and 50 ml of formaldehyde and 20 ml sodium borate. Make sure you mix the jar contents thoroughly by turning the jar end over end several times before placing it in the appropriate box. Continue to split the sample in this way until all of it is preserved.

Reattach the clean codends to the bongo nets only after both sections of the net are thoroughly rinsed out and inspected for trapped algae in the seams. While on deck, rinse out the buckets used for carrying the codends/samples before the next station to insure that there is no contamination from the last sample.

ASOUND (Atmospheric Weather Balloons)

The release of atmospheric weather balloons. These are not released on a regular basis and any instructions will be given when needed.

BIOOTHER (Other Biological Sample)

Occasionally a biological sample is collected that does not fall under any specific sample type. Be sure to include an explanation in the comments of the DSDB form.

DEPLOY (Deployment of Buoy or Mooring)

Any instructions regarding deployment procedures will be given on a case by case basis. Record bouy number or mooring number on DSDB.

A deployment of a buoy or mooring will be given an independent station number unless there will be sampling in conjunction with this operation. In this case, the deployment may be given a station number and a haul number with the sampling being called the same station number but consecutive haul numbers used.

DISCARD

The DSDB was created such that every gear or net entry must have at least one corresponding sample entry. If a gear or net collection fails, BUT SOME DATA WAS COLLECTED ON THAT HAUL, you must enter the failed gear / net in the DSDB with DISCARD as the sample type.

Example
A 60 cm bongo tow is done with the intention of saving both nets as QTOWF. When the net is brought on board, you notice that net 2 has a broken codend. The decision is made not to redo the entire haul, but to save the contents of net 1 as QTOWF. Net 2 should be entered in the DSDB with perfomance= FAIL and sample type= DISCARD. If the decision had been made to redo the entire haul, then there is no need to enter the failed haul in the DSDB.

FOCI also uses DISCARD in situations involving rough counts. When a rough count is done, but the codend is not saved (as in QTOWF), the sample types entered in the DSDB would be RCOUNT and DISCARD.

JELLY PROBLEMS

Jellyfish and ctenophores may look pretty, but they can be a big problem when it comes to preserving a plankton sample. If there is more than one or two small jellyfish/ctenophores per codend, then they will have to be removed.

1) Culling The Population

Pour the codend contents into a 12 inch sieve. Pick up each jellyfish and/or ctenophore and hold it over the sieve while rinsing it off with seawater from a squeeze bottle. If the jellyfish/ctenophore is a handful, then have someone else rinse it off while you hold it over the sieve. Inspect each specimen to be sure that it is clean of larvae and plankton.

In the event of a large jellyfish with gear tangled tentacles, the rinse-down of the jellyfish will have to be done while still on deck. Carefully untangle the jellyfish from the gear and rinse it off, using a seawater squeeze bottle (not the hose), into the net before the codend is removed. This is definitely a two person task and should be done as quickly as possible.

2) Overboard

Return the jellyfish and ctenophores to the sea as soon as possible since they often survive the entire process.

Do not measure or preserve jellyfish for predation studies unless you have received a proper request for them---a.k.a. Sample Request Form.

LIVE (Collection of Live Organisms For At-Sea Experiments)
The collection of zooplankton, predators, or eggs for live experimental work at sea. These samples are not collected on a regular basis and are by special request only.

PHYOTHER (Other Physical Sample)
A physical sample collected that does not fall under any specific sample type. Be sure to include an explanation in the comments of the DSDB form.

RECOVERY (Recovery of Buoy or Mooring)

Any instructions regarding recovery procedures will be given on a case by case basis. Record bouy or mooring number on DSDB.

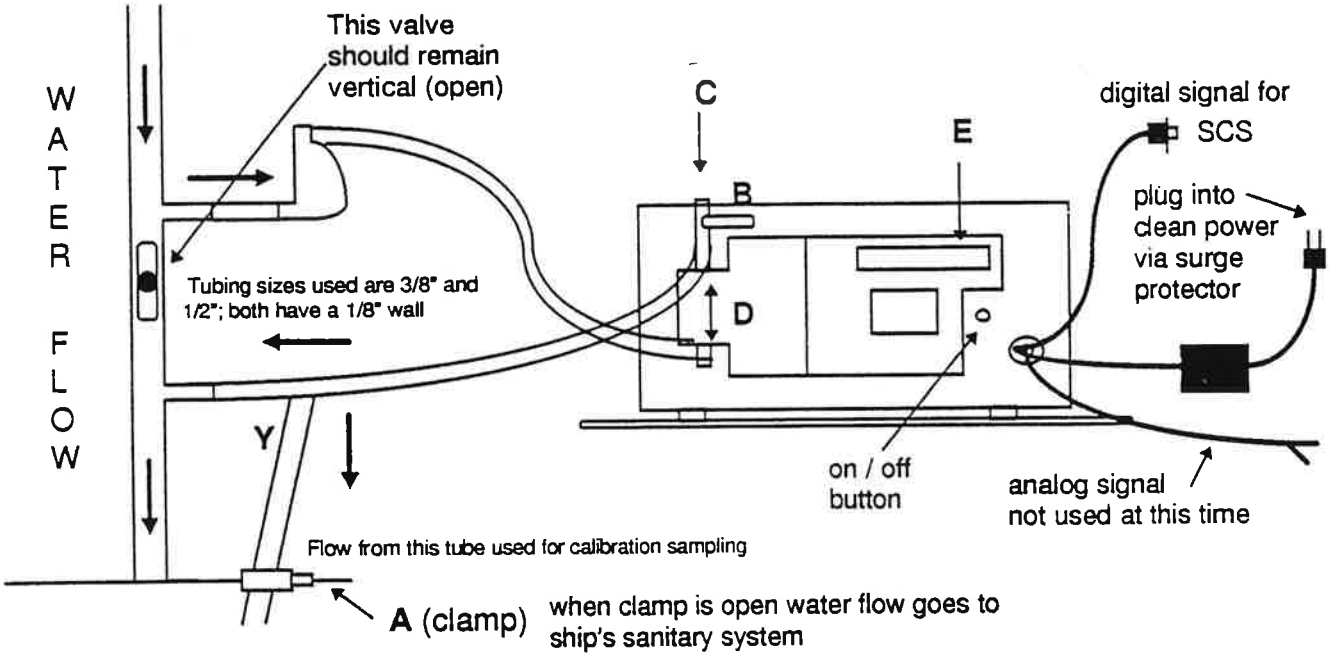
A recovery of a buoy or mooring will be given an independent station number unless there will be sampling in conjunction with this operation. In this case, the recovery may be given a station number and a haul number with the sampling being called the same station number but consecutive haul numbers used.

SURFACE CHLOROPHYLL SAMPLES

Seawater from the scientific seachest (Miller Freeman) is pumped to the Chem Lab and through a Turner Designs continuous flow fluorometer. The SCS system records the fluorescence values. The scientists are responsible for collecting calibration samples and maintenance.

Preparation

Setup the fluorometer in the aft corner of the Chem Lab as shown.



When setup is complete, turn on seawater pump (switch is located above the starboard sink on the quarter deck). All tubing down to **Y** must be wrapped with black electrical tape after flow with little or no bubbles/leaks has been established. This prevents light shock of the phytoplankton after leaving the ocean and entering lighted lab.

Collection

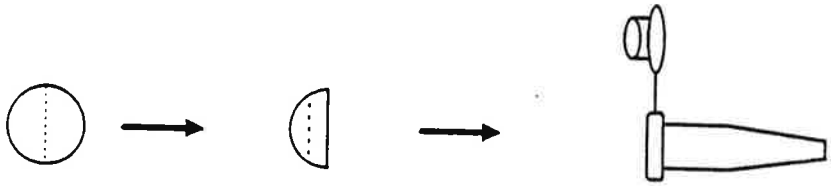
The fluorometer will continuously record phytoplankton fluorescence. It is periodically necessary to take chlorophyll calibration samples. Calibration samples are usually taken on station or at specified times on dedicated transects. The chlorophyll manifold is required for filtration; if it is not already setup, then follow the instructions on the CHLOR page in SAMPLING.

SURFACE CHLOROPHYLL SAMPLES (cont'd)

SAMPLE COLLECTION:
Open the screw clamp (labelled **A**). Allow the water to flow for a few seconds (PLEASE NOTE THAT WATER FROM SINK GOES TO THE SHIP'S SANITARY SYSTEM; BE CAREFUL ON HOW LONG YOU LEAVE THE CLAMP OPEN) and fill plastic calibrated bottle to the top (gently tap to remove air bubbles and add more water if necessary) and screw cap on.

Note GMT time and fluorescence value from screen (labelled **E**). See RECORD KEEPING section.

Gently pour sample into filter cup and filter sample using low vacuum (7 psi). When finished, remove filter cup. Use two forceps to fold filter into fourths with filtered material (color) on the inside, being careful not to touch colored area with the forceps.



Place filter into labelled (see Labelling) microcentrifuge tube. **Please do not jam filter into bottom** because they are difficult to remove when frozen.

Labelling
Use a fine point permanent marker to label.

Samples collected on station:
Label microcentrifuge tube with FOCI cruise# and station-haul.

Samples collected while underway:
Label microcentrifuge tube with FOCI cruise#, GMT date and GMT time.

Preservation
Place microcentrifuge tube in cruise labelled white freezer box in -80° C freezer.

Record Keeping
Record the GMT date, GMT time, fluorescence value and volume filtered (station and haul if applicable) on the Flow-thru Chlorophylls and/or Absorbance Samples sheet (a copy is found in the FORMS section of this manual).

SURFACE CHLOROPHYLL SAMPLES (cont'd)

Maintenance

Clean the fluorometer flow cell once a day. The cell is a fragile quartz inside the instrument. Be extremely gentle during cleaning so as not to break the cell.

Turn off the fluorometer (red button) and then shut down the seawater pump (switch is located above the starboard sink on the quarter deck). Open the screw clamp (labelled **A**) to drain water from the system. Gently move the yellow valve (labelled **B**) to a vertical position. Locate the soft bristled brush; rinse it with distilled water and insert it into the opening (labelled **C**). Be sure to push the brush in far enough to clean the cell (located in the region labelled **D**). Move the yellow valve back to the horizontal position. Turn the seawater pump back on. Wait until all the excess air is out of the system before closing the screw clamp and turn the fluorometer back on. Please record GMT time of cleaning (start and stop) in green fluorometer log book.

Miscellaneous

If you ever notice that the fluorometer values have 'pegged' (i.e., values are constant), notify the Chief Scientist or Survey Tech.

Turner Designs 10-AU Fluorometer manufactured by:

Turner Designs
845 W. Maude Avenue
Sunnyvale, CA 94086 (408) 749-0994

XBT (Expendable Bathythermogragh)

XBTs provide a quick method to obtain a temperature profile, even while underway. There are different probes available, depending on depths to be sampled. We usually provide XBT's if their use is planned.

Section: DSDB
List of Contents

DISCRETE SAMPLE DATABASE (DSDB) PAPER ENTRY FORM AND DSDB RBASE APPLICATION

Introduction
The DSDB paper entry form is an integral part of the FOCI DSDB Rbase application. It encompasses both the old station plankton log form and the recent database application. The following information is intended to help the user fill out the DSDB paper entry form correctly and offer hints to entering data in the DSDB Rbase application. Complete DSDB Rbase application documentation may be found in the DSDB Rbase application manual.

The DSDB Rbase application has several important functions:
1) to help Chief Scientists write cruise reports at sea
2) to help facilitate the writing of the field operations reports
3) to help facilitate the interdisciplinary goal of the FOCI project by recording all biological and physical sampling information. This in turn can be used to access pertinent ichthyoplankton data on the ichthyoplankton database.
4) aid in shipment, tracking, and sorting requests for samples sent to Poland.

Information regarding DSDB paper entry form and the DSDB Rbase application are divided into the following subsections:

STATION / HAUL INFORMATION
GEAR INFORMATION
PERFORMANCE
PURPOSE
GEAR TYPES
SAMPLES COLLECTED

STATION / HAUL INFORMATION

The DSDB Rbase application is designed for entry of individual operations, gears and nets. Station / haul information may be the same for several entries (i.e., a 60 cm bongo with the SEACAT attached will have three entries: 60BON - net 1 , 60BON - net 2 and CAT). Both the DSDB paper entry form and the DSDB Rbase application have been modified to streamline the entry of repetitive information

The following fields must be correctly completed on the DSDB paper form and have a corresponding entry in the DSDB Rbase application. The DSDB Rbase application will not allow you to enter corresponding gear and sample data unless all the requested fields are complete. Note however, that incorrect station / haul data will be linked to all gears / nets that you associate with the station / haul data. The user will need to edit all incorrect station / haul records separately.

FOCI CRUISE

This entry is based on the year, the ship being used, and how many cruises on that ship have had FOCI operations. For example, the first Miller Freeman cruise in 1995 in which FOCI operations are performed would be 1MF95. This is determined before the field season begins.

STATION

The station number is a consecutive integer without, as in the past, any prefixes or suffixes. As a rule of thumb, **the station number should change if the vessel moves more than 1/2 nautical mile from the first operation with a specific station number**. Sometimes, however, it makes sense to ignore the distance rule, and maintain the same station number so as to make the retrieval of related sampling data easier. For example, transects shall have the same station number with the start being haul 1 and the end being haul 2, regardless of how far the ship is from the initial station location. Two stations done in conjunction with a drifter bouy should all have the same station number.

HAUL

The haul number increases sequentially with every operation performed at a specific station. The term "haul" may be a bit confusing as it refers to any individual operation whether it is an actual haul or not. For example, a "haul" may be a transect beginning, mooring deployment or an XBT cast.

FOCI STATION

The FOCI station number indicates any preset station designation (e.g., grid station designation or FOX station number) except mooring numbers. This field can be used to compare data from long term sampling stations and grids. It is important to include any and all leading zeroes for FOX stations (i.e., FOX055).
DSDB Rbase application: This field will default to "None" unless you enter data.

STATION INFORMATION (cont'd)

ALTERNATE STATION
This entry can ONLY be the CTD number or the MOCNESS number. It is important to include any and all leading zeroes (i.e., CTD001).
DSDB Rbase application: This field will default to "None" unless you enter data.

SHIP CRUISE
This is the consecutive cruise number used by NOAA vessels and PMEL. It can be obtained by asking someone on the Bridge.

GM-DATE
This is the date as determined by Greenwich Mean Time. On cruises in Alaskan waters the GM-Date changes at 1500 or 1600 hours depending on whether Daylight Savings Time is in effect. If in doubt, ask the Bridge.

GM-TIME
The Greenwich Mean Time used for an operation is determined at the bottom of a cast. This information should be taken from the Marine Operations Abstract (MOA) which is kept on the Bridge. All NOAA ships working with FOCI are supposed to keep a MOA. In cases where this does not occur, watchstanders must record this information.

BOTTOM DEPTH
Bottom depth should be obtained from the MOA. It is recorded at the maximum depth of the cast. Be sure that it is in meters, not fathoms. Sometimes the Bridge watch will record this figure in fathoms.

DLAT, MLAT, DLONG, MLONG
Degrees and minutes of latitude and longitude are all taken from the MOA. Please be as precise as the MOA.

HAUL COMMENTS
These are any comments of interest that are specific to an individual operation. Mooring station designations, satellite buoy numbers, and explanation of an "OTHER" entry in purpose are examples of things that should go in this field. If in doubt, enter it.
DSDB Rbase application: You will automatically be prompted for haul comments. If there are no haul comments to be entered, then you must choose EXIT, then "Save changes" NO.

WIRE OUT
Rate at which a gear descends in meters per minute. The rate of deployment is specified in the FOCI Field Manual or the cruise instructions. If the actual rate varies greatly from what is prescribed, then enter the actual rate in this field and the reason for deviation in haul comments.
DSDB Rbase application: This information is not entered.

STATION INFORMATION (cont'd)

WIRE IN

Rate at which a gear is retrieved in meters per minute. The rate of retrieval is specified in the Field Manual or the cruise instructions. If the actual rate varies greatly from what is prescribed, then enter actual rate in this field and the reason for deviation in haul comments.
DSDB Rbase application: This information is not entered.

SCIENTIST COMPLETING FORM

Please enter your initials here. This is important if there is any confusion as to what has happened during a particular operation. This makes it is easier to find the persons who know how and why fields were completed the way they were.
DSDB Rbase application: This information is not entered.

GEAR INFORMATION

The DSDB paper entry form has five sections for gear / net entry, with the MOCNESS having its own DSDB paper entry form. **As a rule of thumb, each gear or net of a particular gear will have its own section filled out on the DSDB paper entry form and entered into the DSDB Rbase application except when absolutely no samples were collected from it.** For example, if you use the SEACAT to determine the depth of a tow, but you do not save the corresponding file, then there was no data collected from that gear. More familiar, is the use of the 20 cm bongo with the 60cm bongo where net 2 is generally discarded (unless net 1 fails). Flowmeter information is recorded on the DSDB paper entry form as a check for net 1 information, but it does not need to be recorded in the DSDB Rbase application.

Because the DSDB paper entry form and DSDB Rbase application are used to enter many different kinds of operations, certain gear types will need to have more of the fields filled in than others. For example, a bongo tow needs net, mesh, flowmeter, tow time, depth, wire out and wire angle information whereas an anchovy trawl or a transect does not. The DSDB Rbase application is designed to prompt you only for the information required and skip over what you do not need.
Each gear / net section contains the following fields with standard protocol as follows:

GEAR
Enter one of the abbreviated Gear Type choices. *Standard gear protocol is described in the FOCI Field Manual, but always be sure to check the cruise instructions for specific requests.*

NET
Generally 1, 2 or N (for None) depending on gear.
DSDB Rbase application: The field will default to "N" unless you enter data.

MESH
Mesh size should be recorded in micrometers as the largest mesh size used on the net (i.e., if the net is 505 µm and the codend in 1500 µm, then the mesh size should be entered as 1500).

FLOWMETER
Meter No.: The four digit identification number found on the flowmeter.
DSDB Rbase application: Entry of the flowmeter number is done by selecting the meter number from a pop-up menu. All flowmeters that are being used on a cruise must first be entered into the database as they are being used for the first time (DO NOT JUST ENTER THE ENTIRE LIST AT ONCE). To do this, you select 'Enter new flowmeter numbers and calibrations ' from the 'Data Entry' menu. You will be prompted for 'Meter No.', 'Meter Slope ' and 'Meter Intercept' which can be obtained from the flowmeter calibration sheet provided by J. Clark.

GEAR INFORMATION (cont'd)

Final Rev.: Final revolutions are the first five digits (the sixth digit is tenths and readings should be rounded accordingly) of the meter after the tow has taken place.
DSDB Rbase application: This information is not entered.

Initial Rev.: Initial revolutions are the first five digits (the sixth digit is tenths and readings should be rounded accordingly) of the meter before the tow has taken place. Usually Final Rev. information from the previous tow can be recorded as the Initial Rev. for the tow, but it is always a good idea to re-check the reading prior to deploying.
DSDB Rbase application: This information is not entered.

Total Rev.: Subtract Initial Rev. from Final Rev. to get total revolutions. It is good practice to check flowmeter revs from each side of the net to make sure they are similar.

TOW TIMES
All net tows except TUCK1, TUCK3 AND SLED will only need TOTAL TOW TIME recorded.
See TUCK1, TUCK3 and SLED for specifics regarding other time fields.

TOTAL TOW TIME: Tow time begins when the flowmeter is submerged and ends when it reaches the surface. It is recorded in minutes and seconds.

DEPTH
Min.: The minimum depth (meters) at which a gear fishes.

Max.: The maximum depth (meters) at which a gear fishes or opens. This is generally determined by electronic means, but can be roughly calculated by the formula: *wire out * cosine (wire angle at depth) = max. depth.*

WIRE OUT
Min.: Minimum wire out (meters) is recorded when a net is at its minimum fishing depth.

Max.: Maximum wire out (meters) is recorded when a net is at its maximum fishing depth. It is important for determining depth should electronic means fail.

WIRE ANGLE AT DEPTH
Wire angle at depth is the angle of the wire just prior to gear retrieval, with zero being vertical. It is important for determining depth should electronic means fail.
DSDB Rbase application: This information is not entered.

NET COMMENTS
Any information that is specific to a particular net (i.e., a tear in the net or a broken codend). Net comments may be used to explain why one net of a bongo failed or a BIOOTHER sample collected. When in doubt, enter it.

PURPOSE

The purpose field represents the main goal of the operation. Different purposes are allowed for separate gears or nets on a tow (i.e., a SEACAT used with a 60 cm bongo; the purpose of the SEACAT is to collect physical data (PHYS) and the purpose of the 60 cm bongo may be for a plankton survey (PLNKSURV)).

GRIDPRE
The first occupation of an area whose primary purpose is to locate areas of high plankton abundance. This survey is used to determine where a main sampling grid should be performed.

GRID
A large-scale grid of pre-specified stations whose primary goal is to estimate plankton areal abundance. This may be on a large or small scale.

GRIDPOST
The reoccupation of a surveyed area (on that cruise) whose primary goal is to estimate plankton abundance. (Usually used for egg survey work.)

PLNKSURV
The surveying of plankton (either ichthyoplankton or zooplankton). It is not part of a large scale survey, but rather fewer stations to quantitatively survey an area or an exploratory sample to determine the presence or absence of organisms. It is a good idea to explain this in the haul comments.

JUVSURV
Sampling done to determine the abundance and distribution of juvenile pollock.

DIEL
Samples collected to study day/night differences. Sampling is usually done at one location over the course of at least one day and one night.

DRIFT
Samples collected while following a drifter buoy. The purpose of this sampling is to study a particular patch of water. It may encompass day and night sampling, but unless the specified goal is to study day/ night differences, the purpose is drift.

PHYS
Any sampling done to sample physical factors whose purpose is not diel or drift.

GEAR
Sampling done to determine the relative sampling efficiency of different gears.

PURPOSE (cont'd)

ADULT
Any sampling done to collect adult fish.

OTHER
Any operation whose purpose does not fall under any of the above purposes. Be sure to explain in haul comments (if it pertains to an entire haul) or net comments (net specific).

PERFORMANCE
Describes the performance of a particular gear or net.

GOOD
Any operation that is completed as planned.

FAIL
FAIL is used to identify any gear/net whose performance failed during a haul when used in conjunction with a sucessful gear/net, but no sample was saved from that gear/net.

Example
A 60 cm bongo tow is done with the intention of saving both nets as QTOWF. When the net is brought on board, you notice that net 2 has a broken codend. The decision is made not to redo the entire haul, but to save the contents of net 1 as QTOWF. Net 2 should be entered in the DSDB with perfomance= FAIL and sample type= DISCARD. If the decision had been made to redo the entire haul, then there is no need to enter the failed haul in the DSDB.

QUEST
Any operation in which there is some question as to whether or not it was successful, yet a sample was kept. This may include unusually high or low flow counts or a hole in a net.

LOST
Any operation that was successfully completed, but the sample was subsequently lost and the sampling was not repeated (i.e. a broken sample jar or a spilled sample).

GEAR TYPES

The following section will describe how the gear relates to the DSDB paper entry form and possible points of confusion regarding the DSDB Rbase application. Field entries follow GEAR INFORMATION standards where performance is GOOD, QUEST or LOST unless otherwise noted.

20BON (20 cm bongo)
Most often used in conjunction with the 60 cm bongo.
NET: Either 1 or 2. In the standard sampling plan, net 2 is retained only if net 1 fails. If no samples are taken from net 2 and it is not preserved, then there is no reason to enter any information in the DSDB Rbase application for net 2. It is however wise to fill out all the fields on the DSDB paper entry form and check the Total Rev. count against the Total Rev. count from net 1 to see if there are any discrepancies between the flowmeters.

60BON (60 cm bongo)
NET: On larval surveys it is common to use net 2 for a rough count (RCOUNT). Even if the remaining contents of the net are not preserved, net 2 must be entered in the DSDB Rbase application because a RCOUNT was taken (for this example SAMPLES COLLECTED: RCOUNT, DISCARD and L-OTO (if RCOUNT was kept for otolith analysis)).

ASOUND (Atmospheric weather balloons)
DEPTH: Max depth always 0
PURPOSE: Always PHYS
SAMPLES COLLECTED: Always ASOUND

ANCHO (Anchovy trawl)
The main purpose of the entry of an Anchovy trawl into the DSDB Rbase application is to record when and where the trawl took place. See the FOCI Field Manual GEAR section for information regarding specific trawl forms that may need to be filled out.
HAUL COMMENTS: If the EMPS is used with this gear record 'EMPS used'.

BIOOTHER: A gear which measures biological properties that is not covered by any of the specific gear types.
HAUL COMMENTS: Must be filled in.

BOTTLES (Nansen or Niskin bottles sent down on the wire without the CTD).

CALVET (CalCOFI vertical egg tow net)
TOW TIMES: Record time on retrieval only. Net is designed to flush on descent.

GEAR TYPES (cont'd)

CAT (SEACAT CTD)
If the CAT is used only as a depth device and no file is saved, then there would be no entry in the DSDB Rbase application.
SAMPLES COLLECTED: Always CAT.
HAUL COMMENTS: If it is used to determine depth but no file is kept then note 'CAT was used to determine depth' for the gear which it was used.

CTD (CTD cast)
SAMPLES COLLECTED: Always CTD

CTDB (CTD with water samples collected from Nisken bottles)
SAMPLES COLLECTED: CTD should always be entered as one of the samples. Any of the samples collected with the bottles should also be entered.

DIAM (Diamond trawl)
The main purpose of the entry of a Diamond trawl into the DSDB Rbase application is to record when and where the trawl took place. See the FOCI Field Manual GEAR section for information regarding specific trawl forms that may need to be filled out.

EASTERN (Eastern trawl or 83-112 Bottom trawl)
The main purpose of the entry of an Eastern trawl into the DSDB Rbase application is to record when and where the trawl took place. See the FOCI Field Manual GEAR section for information regarding specific trawl forms that may need to be filled out.

EBKG (Electronic bathykymograph)
If the EBKG is used only as a depth device and no file is saved, then there would be no entry in the DSDB Rbase application.
SAMPLES COLLECTED: Always EBKG.
HAUL COMMENTS: If it is used to determine depth but no file is kept then note 'EBKG was used to determine depth' for the gear which it was used.

IKMT (Isaacs-Kidd midwater trawl)

IKS (Soviet vertical ring net)

LG-CB (10" ID modified Clarke-Bumpus)
The Clarke-Bumpus has been modified by FOCI for use inside the TUCK1, TUCK3 and SLED.
NET: When used inside another gear, net number should be the same as the gear's net in which it is contained.

LIVE (Live vertical tow from a 60cm bongo with taped codends)
Net: Net will default to 'N' because net number is not important for LIVE tows.

GEAR TYPES (cont'd)

MARIN (Marinovich trawl)
The main purpose of the entry of a Marinovich trawl into the DSDB Rbase application is to record when and where the trawl took place. See the FOCI Field Manual GEAR section for information regarding specific trawl forms that may need to be filled out.

METH (Methot midwater trawl)
This trawl has a flowmeter and accordingly must have the pertinent net information filled in.
FLOWMETER: If used in conjunction with a LG-CB, then flowmeter information should be taken from the flowmeter in the Lg-CB.

MOC1 ($1m^2$ MOCNESS)
MOC1 has a separate DSDB paper entry form labelled MOCNESS.

MOC2 ($2m^2$ MOCNESS)
MOC1 has a separate DSDB paper entry form labelled MOCNESS.

MOOR (Oceanographic mooring at a fixed location)
PURPOSE: Always PHYS.
SAMPLES COLLECTED: Either DEPLOY or RECOVERY.
HAUL COMMENTS: Always put the PMEL mooring designation in this field.

NETFLUOR (Fluorometer attached to a net)
SAMPLES COLLECTED: Always NETFLUOR.

NEU (Neuston sampler)
NET: Always 1.
DEPTH: Max Depth Always 0.

NOR (Nor'eastern bottom trawl)
The main purpose of the entry of a Nor'eastern bottom trawl into the DSDB Rbase application is to record when and where the trawl took place. See the FOCI Field Manual GEAR section for information regarding specific trawl forms that may need to be filled out.

PHYOTHER: A gear which measures physical properties that is not covered by any of the specific gear types.
HAUL COMMENTS: Must be filled in.

RING.8 (Live zooplankton .75 m ring net)

RING1 (1 m ring net)

GEAR TYPES (cont'd)

ROPE (Rope trawl)
The main purpose of the entry of a Rope trawl into the DSDB Rbase application is to record when and where the trawl took place. See the FOCI Field Manual GEAR section for information regarding specific trawl forms that may need to be filled out.

SATBUOY (Satellite tracked drifter deployment)
DEPTH: Max depth is the depth at which the buoy is drogued.
PURPOSE: Always PHYS.
SAMPLES COLLECTED: Always DEPLOY.
HAUL COMMENTS: Always enter buoy identification number in this field.

SCANMAR (SCANMAR)
If the SCANMAR is used only as a depth device and no file is saved, then there would be no entry in the DSDB Rbase application.
SAMPLES COLLECTED: Always SCANMAR
HAUL COMMENTS: If it is used to determine depth but no file is kept, then note 'SCANMAR was used to determine depth' for the gear which it was used.

SEDTRAP (Sediment trap)
SAMPLES COLLECTED: DEPLOY when set out. RECOVER and BIOOTHER when recovered.
HAUL COMMENTS: Note preservative type when using BIOOTHER sample abbreviation.

SHIPBUOY (A radar tracked drifter buoy)
DEPTH: Max depth is the depth at which the buoy is drogued.
PURPOSE: Always DRIFT.
SAMPLES COLLECTED: Either DEPLOY or RECOVER.

SHRIMP (Shrimp trawl)
The main purpose of the entry of a Shrimp trawl into the DSDB Rbase application is to record when and where the trawl took place. See the FOCI Field Manual GEAR section for information regarding specific trawl forms that may need to be filled out.

SLED (Epibenthic sled)
FLOWMETER: If used in conjunction with a LG-CB, then flowmeter information should be taken from the flowmeter in the Lg-CB.

SM-CB (5" ID Clarke-Bumpus)

GEAR TYPES (cont'd)

TRANS (Dedicated transects)
A dedicated transect is defined as a continual underway collection of data (e.g. no stations between beginning and end). It does not refer to vessel mounted sensors that are constantly logging data unless there is a specific request for a dedicated transect.
STATION: A new station number is given at the beginning of a transect and only the transect shall have that station number.
HAUL: The beginning of a transect is haul 1 and the end of the transect is haul 2.
DEPTH: Max depth always 0.
PURPOSE: For the sake of consistency it should always be PHYS, even for the EK500.
SAMPLES COLLECTED: Can only be ADCP, EK500, SSF or TSG.

TUCK1 (1 m^2 TUCKER trawl)
NET: This should be 1 or 2; the drogue net does not have an entry.
FLOWMETER: If TUCK1 is used in conjunction with LG-CB, then flowmeter information is taken from the LG-CB.
TOW TIMES: Please refer to the diagram for the TUCK1 in the FOCI Field Manual GEAR section as to what each time field represents. The most important point to note is that the total tow time for either of the TUCK1 nets is the time elapsed between when the messenger opens the net until the next messenger closes that net or the net reaches the surface.

TUCK3 (3m^2 TUCKER trawl)
NET: This should be 1 or 2; the drogue net does not have an entry.
FLOWMETER: If TUCK3 is used in conjunction with LG-CB, then flowmeter information is taken from the LG-CB.
TOW TIMES: Please refer to the diagram for the TUCK1 in the FOCI Field Manual GEAR section as to what each time field represents. The most important point to note is that the total tow time for either of the TUCK1 nets is the time elapsed between when the messenger opens the net until the next messenger closes that net or the net reaches the surface.

VIDEOCTD (Video camera mounted on CTD rosette)

VIDEONET (Video camera mounted on a net sampler)

XBT (Expendable bathythermograph)
DEPTH: Max. depth is usually the same as bottom depth, but sometimes the XBT will not reach depth. Be sure to check.
PURPOSE: Always PHYS.
SAMPLES COLLECTED: Always XBT.
HAUL COMMENTS: Enter the XBT cast number in this field.

SAMPLES COLLECTED

For each operation there must be a "sample" collected. This may not necessarily be a biological sample, but rather a computer file or a job accomplished as in the case of a mooring recovery or the end of a transect. The following is a list of possible sample types and their definitions. Information regarding collection procedures can be found in the FOCI Field Manual SAMPLING section. The field NUM is new to the database and will allow the user to more accurately tally specific samples and operations. See each sample abbreviation for the definition of NUM for that sample.

ABSORB (Spectral absorbance samples collected from CTD casts)
NUM: # of samples collected.
GEAR: Either CTDB or BOTTLES.

ADCP (ADCP data collected on dedicated transects)
NUM: Always 1.
GEAR: Always TRANS.
HAUL: Always 1 for transect beginnings and 2 for transect endings.

A-GENET (Adult genetic tissue samples)
NUM: # of fish sampled.

A-GUT (Adult stomachs collected for gut content analysis)
NUM: # of fish sampled, all species.

A-LENGTH (Adult pollock length measurements)
NUM: # of fish sampled.

A-OTO (Adult pollock otolith collections)
NUM: # of fish sampled.

A-WGHT (Adult pollock weight measurements)
NUM: # of fish sampled, only pertains to individual recorded weights.

ASOUND (Atmospheric weather balloon release)
NUM: # of balloons released.

BIOOTHER (Biological sample collected that does not fit any specific sample type)
NUM: # of samples collected.
NET COMMENTS: must be filled out if HAUL COMMENTS aren't.
HAUL COMMENTS: must be filled out if NET COMMENTS aren't.

BKG-CAL (Calibration of manual bathykymograph)
NUM: Always 1.
GEAR: Either CTD or CTDB.

SAMPLES COLLECTED (cont'd)

BLOOD (Blood collection from adult pollock)
NUM: # of fish sampled.

BRAIN (Brain tissue samples from larval pollock)
NUM: # of fish sampled.

CAT (Data collected from the SEACAT (file saved))
NUM: Always 1.

CHLAM (Chlorophyll absorption meter mounted on CTD/Rosette)
NUM: Always 1.
GEAR: Either CTD or CTDB.

CHLOR (Chlorophyll samples collected from CTD casts)
NUM: # of samples collected.
GEAR: Either CTDB or BOTTLES.

CTD (CTD data collected)
NUM: Always 1.
GEAR: Either CTD or CTDB.

DEPLOY (Deployment of a buoy or mooring)
NUM: # deployed.
GEAR: Either MOOR, SATBUOY, SHIPBUOY OR SEDTRAP.

DISCARD (No sample collected due to gear, net, sample handling failure or no request for sample preservation if other data was collected from net)
NUM: Always 1.

EBKG (Data collected and saved from the electronic bathykymograph)
NUM: Always 1.

EK500 (EK500 data collected on dedicated transects)
NUM: Always 1.
GEAR: Always TRANS.
HAUL: Always 1 for transect beginning and 2 for transect end.

FLUOR (Fluorometer data collected from a CTD cast)
NUM: Always 1.
GEAR: Either CTD or CTDB.

SAMPLES COLLECTED (cont'd)

J-GENET (Juvenile pollock collected for genetic studies)
NUM: # of fish sampled.

J-GUT (Juvenile pollock collected for gut content analysis)
NUM: # of fish sampled.

J-LENGTH (Juvenile pollock length measurements)
NUM: # of fish sampled.

J-OTO (Juvenile pollock otoliths)
NUM: # of fish sampled.

J-WGHT (Juvenile pollock weight measurements)
NUM: # of fish sampled, only pertains to individual recorded weights.

L-BIOCH (Larval biochemistry samples)
NUM: # of fish sampled.
GEAR: Always LIVE.

L-GUT (Larval gut samples)
NUM: # of fish sampled.

L-HIST (Larval histology samples)
NUM: # of fish sampled.
GEAR: Always LIVE.

LIVE (Collection of live organisms for at sea experiments)
NUM: Always 1.

L-MUSC (Larval pollock muscle DNA samples)
NUM: # of fish sampled.
GEAR: Always LIVE.

L-OTO (Larval otolith samples)
NUM: # of fish sampled.

LUGOLS (Samples preserved in Lugols collected from a CTD cast)
NUM: # of samples collected.
GEAR: Either CTDB or BOTTLES.

MERIST (Samples collected for meristic studies)
NUM: # of fish collected.

SAMPLES COLLECTED (cont'd)

MZ (Microzooplankton samples collected from a CTD cast)
NUM: # of samples collected.
GEAR: Either CTDB or BOTTLES.

NETFLUOR (Data collected from fluorometer attached to net tow)
NUM: Always 1.

NUT (Nutrient samples collected from a CTD cast)
NUM: # of samples collected.
GEAR: Either CTDB or BOTTLES.

OVARY (Adult pollock ovary collections)
NUM: # of fish sampled.

PAR (Light meter data collected on a CTD cast)
NUM: Always 1.
GEAR: Either CTD or CTDB.

PHYOTHER (Physical sample collected that does not fit any specific sample type)
NUM: # of samples collected.
NET COMMENTS: must be filled out if HAUL COMMENTS aren't.
HAUL COMMENTS: must be filled out if NET COMMENTS aren't.

PHYTOF (Phytoplankton samples preserved in formalin collected from a CTD cast)
NUM: # of samples collected.
GEAR: Either CTDB or BOTTLES.

POC (Particulate organic carbon samples collected from a CTD cast)
NUM: # of samples collected.
GEAR: Either CTDB or BOTTLES.

PRED (Predator collections)
NUM: # or predators collected.

QTOWF (Quantitative tow preserved in formalin)
NUM: # of jars used.

QTOWS (Quantitative tow preserved in Stockards)
NUM: # of jars used.
NOTE: This should only be used if it is a quantitative sample that will be sent to Poland for processing, if it is not then, it should be assigned a sample abbreviation of BIOOTHER and explained in haul or net comments.

SAMPLES COLLECTED (cont'd)

RCOUNTE (A rough estimate of pollock egg abundance collected at sea)
NUM: Estimated number of pollock eggs in sample.

RCOUNTE (A rough estimate of pollock egg abundance collected at sea)
NUM: Estimated number of pollock larvae in sample.

RECOVERY (Recovery of a buoy or mooring)
NUM: # recovered.
GEAR: Either MOOR, SHIPBUOY OR SEDTRAP.

SCANMAR (Data collected from SCANMAR (file saved))
NUM: Always 1.

SHRINK (Shrinkage experiment samples)
NUM: # of fish measured.

SSF (Sea surface fluorescence data collected on dedicated transects)
NUM: Always 1.
GEAR: Always TRANS.
HAUL: Always 1 for transect beginning and 2 for transect end.

STRIP (Strip spawning of adult pollock)
NUM: Always 1.

TSG (Thermosalinograph data collected on dedicated transects)
NUM: Always 1.
GEAR: Always TRANS.
HAUL: Always 1 for transect beginning and 2 for transect end.

VIDEOCTD (Video camera attached to a CTD cast)
NUM: Always 1.
GEAR: Either CTD or CTDB.

VIDEONET (Video camera attached to a net tow)
NUM: Always 1.

XBT (Expendable bathythermograph)
NUM: # of XBTs released.

THE APPLICATION

Once you have successfully filled out the DSDB form, the next step is entry of this data into the application itself. This section of the manual will go through the application. Much of the entry process will be self-explanatory and closely follows the paper form. Instructions are often displayed at the bottom of the screen or appear at the bottom of the screen when the cursor enters a data entry or edit field. Some fields, however, merit further comment and will be noted in this section.

The first screen prompts you for your name. This is done for record keeping within the application and can be used to determine who did what and when.

The next screen prompts you for information that will be used for the rest of the session. If for any reason this information changes (specifically the hemisphere of longitude), you must exit the application and re-enter to change this information.

The main application screen will appear next. Along the top of the screen is the menu bar. To move around on the menu bar you may either use the direction arrows, the mouse, or choose options by number or letter.

DATA ENTRY

Enter New SAMPLE & STATION Data For:

1. Bongo/Bongo Array and Calvet

   For 20/60 bongo arrays and calvets (both may include the Seacat), the tow times, maximum and minimum depths and wire out are the same for all gear/nets. This option automatically fills in this data for subsequent gear/nets for that station/haul after it has been entered the first time. This both saves time and minimizes the possibility of errors.

Areas of comment:

GM-Date: This is automatically filled in and should be carefully watched around the time the GM Date changes (either 3 or 4 pm AST) or if data is entered at a later time.

Bottom Depth/Haul Comments: When the cursor enters the Bottom Depth field it automatically moves you to the Haul Comments entry field first. You may either enter a haul comment, or exit without saving. Either way, it takes you back to the Bottom Depth field and this data may then be entered.

Total Time: The minute and second field **must** have an entry. If either is left blank, then later processes will not function properly.

THE APPLICATION (cont'd)

2. MOCNESS Only

   Because the data needs of the MOCNESS are different than other gears, it has both different paper form and different data entry screens.

Areas of comment:

Latitude, Longitude, and GM-Time: The major differences between the MOCNESS form and other forms is that **each** net of the MOCNESS has this data recorded at depth.

Volume Filtered: This field can only be filled out after the MOCNESS data has been processed. It is doubtful you will ever have to deal with this field.

3. All Other Gear Types:

   This covers all other gear types not covered by the two previous options (although bongos and calvets can be entered through this option). The screens look identical to the first option but there are subtle differences in the entry process.

Areas of comment:

Gear: Which gear you choose will determine which subsequent fields you will need to enter. For most of the ichthy/zooplankton gears you will need to fill all the entry fields (except for net comments) and the cursor will step you through each field. If you choose one of the oceanographic gears or trawls that do not use flowmeters, the cursor will skip over the flowmeter information, Total Time, Min. Depth, Min. WireOut, and Max. WireOut. You cannot leave this screen without entering something into the Max. Depth field. If you are unsure enter zero and correct it at a later time.

Enter New Flowmeter Numbers & Calibrations

It is very important that this information is correct. It is used to determine volumes filtered, at-sea standardized catch information, and ultimately, the catch statistics used for investigations and publications. The calibration information is included in the FOCI Field Manual and it is also included in the box containing the flowmeters.

THE APPLICATION (cont'd)

Enter New Gear Abbreviation and Description

This can be used to add gear types not already included. What is entered is put into the gear dictionary and then appears in the application in the gear entry field pop-up menu. Before adding a new gear, be sure to check that this gear is not already included in the gear dictionary under a different name. The application will not allow you to overwrite or duplicate a gear abbreviation.

Enter New Sample Abbreviation and Description

This can be used to add sample types not already included. What is entered is put into the sample dictionary and then appears in the application in the sample entry field pop-up menu. Before adding a new sample, be sure it is not already included in the sample dictionary under a different name. The application will not allow you to overwrite or duplicate a gear abbreviation.

Exit to DOS

This option takes you to the DOS prompt.

VERIFY DATA

4. Verify STATION & HAUL Data
   Under this option you have the following choices:

   a. Verify that STATION records have corresponding HAUL COMM & SAMPLES records: This allows you to check that there are corresponding sample and haul records for each station record. There must be at least one sample listed for each station.
   b. List cruises in the database: Lists out which records are in the database. **There should only be one cruise.** Any other listings need to be corrected or deleted.
   c. Check for sequential stations and hauls: This lists out all stations/hauls sequentially based on GM Time and GM Date. This is used to make sure that the GM Times and Dates are correct. Any station or haul out of sequence shows an incorrect date or time needs to be corrected.
   d. Verify dates: This prints out a list of all dates in the database. Any date that appears wrong should be investigated and corrected if necessary.

THE APPLICATION (cont'd)

5. Verify Depths & Wire Out

   This option checks the database and prints out all station/hauls where the ratio of wire out to maximum gear depth is out of line. Any records listed should be investigated and corrected as necessary.

6. Verify Revs & Flowmeter Data
   Under this option you have the following choices:

   a. Check revs per second by gear type: When you enter this option it prompts you for the cruise of interest and then asks you to select the gear(s) of interest. The output gives you information about the flow counts and prints out records for stations/hauls where the flowmeter revolutions/second are +/- 2 standard deviations. This option is less useful than the following option for investigating problems since a gear may have more than one flowmeter used during the course of a cruise.
   b. Check revs per second by flowmeter number: This is identical to the above option except that the report is broken down by flowmeter number. This is a much better way to look for mistakes or problems. Any records that are outside of two standard deviations should be investigated.
   c. Check flowmeters: This gives you a list of flowmeters and a list of station/hauls that should have a flowmeter reading but do not.
   d. Look for revs & elapsed time = 0 or null: This prints records where flowmeter readings are zero or null but should not be.

7. Verify Position Data
Under this option you have the following choices:

   a. Verify existence of latitude & longitude data: This option gives you a list of records where latitude and/or longitude data is missing and a list of records with obviously incorrect position information (i.e. minutes of latitude greater than 59.99).
   b. File output for PlotPLus: Do not use this option.

8. Update Catch Statistics
   This option needs to be run before using any of the catch information available. It calculates variables needed for standardized catch statistics (e.g. calibration factor, volume filtered, standard haul factors, egg catch/10 m^2 and larval catch/10 m^2).

THE APPLICATION (cont'd)

9. Print Full Editing Report
   This option prints out the editing report you will need to error check the database. It allows you to select one or more stations and any range within. The printouts need to be checked against the original forms and any discrepancies need to be investigated and corrected if necessary.

EDIT DATA

Once you have compared the editing report to the paper forms and found errors, you will then use this section to make the corrections. **If you have found a problem with any of the components of the haul id. (FOCI cruise, station, haul, gear, net) then you will first have to delete all samples associated with that station/haul/gear/net.** It is set up this way to ensure that both the station and samples information gets changed. If they do not, then there is no way to link them, and this can cause many problems later down the line both on the ship, back at the lab, in Poland, and eventually in the ichthyoplankton database.

Edit for a Particular:

10. Station Number
    This option allows you to access all the hauls associated with a station number. You can move between the various hauls by using the 'Go to' 'Next row options on the menu bar. This option is linear in that it dead-ends at the last haul. To move backwards you must use the 'Go to' 'Previous row' options. You can move between the station, samples, and haul comment information by using the 'Go to' 'Next section' options from the menu bar. This option is circular in that it will continue to cycle through these screens as many times as you want. You may also use the 'Go to' 'Previous section' options.

11. Station & Haul Number
    This option allows you to access only the information associated with the requested station/haul. You can move between the station, samples, and haul comment information the same way as described above.

Edit Flowmeter Data
This allows you to edit any incorrect flowmeter data.

REPORTS
List

Section: CHEMICALS
List of Contents

Aboard Ship

An MSDS package is available in the Survey Office for all of the chemicals that FOCI is responsible for.

Please try to minimize the opportunity for a chemical spill. Remember not to leave chemical containers too near the edge of counters or sinks. If something should be spilled in a small amount, then quickly wipe it up with paper towels, seal in a plastic bag, and have the ship incinerate when possible. A larger spill, such as an entire 5-gallon container of formaldehyde, should be handled according to ship's procedures (probably involving neutralization and flushing overboard with a fire hose).

We provide the ship with the necessary chemicals for neutralization of the chemicals we bring on board.

All FOCI chemical bottles/container should be labelled (use a HMIG label) according to the following:

name of chemical
concentration
components of solution (if applicable)
acid, base, oxidizer, etc.
type of health hazard
age of chemical/solution

Chemicals Aboard Vessels - Chief Scientist Guidelines

Before the cruise:

Know what chemicals you and your group will be working with. You should have a chemical inventory for your cruise which should include chemicals for visiting scientists.

At the beginning of the cruise:

Hold a pre-cruise meeting with as many of your cruise personnel as possible to discuss what chemicals are aboard and what they will be used for. The pre-cruise meeting will be the time to discuss the Standard Operating Procedures for each chemical. The Standard Operating Procedures will cover the following topics:

*** hazard ratings
*** personal protection gear needed
*** special handling instructions
*** first aid
*** spill cleanup procedures
*** deactivation/disposal procedures at sea
*** shipping procedures and restrictions

At the completion of the cruise:

1) Tally each jar/vial size used and calculate how much preservative was used for each container type.

For example:
50 - 1 liter jars of plankton = 50 x 50 mls formaldehyde = 2,500 mls or 2.5 liters formaldehyde used

2) If any formaldehyde or other FOCI chemical has been spilled, make a written estimate of how much of the chemical was lost.

3) Put tallies of used and spilled chemicals (chemical inventory) in the FOCI folder that the Chief Survey Tech. keeps on file in the Survey Office, and keep a copy for yourself.

Directions For Making Sodium Borate Solution

A saturated solution of sodium borate will be needed for the buffering of formaldehyde preserved plankton samples.

This will be a saturated solution so there should always be some sodium borate on the bottom of the container(s) after 24 hours that will not go into solution. For this reason, it will be best to make the solution in a separate container from the one (red carboy) that will have the syringe.

Materials needed:

funnel
4 - 500 g bottles of sodium borate
4 - 1 gallon jugs of distilled water (buy a few extra to make a second batch)
red carboy

1) Pour off ~1 liter of distilled water from each jug to make room for the sodium borate powder. Save the distilled water in another container to top off the jug and for future use.

2) Pour one bottle of sodium borate into one distilled water jug so that you will have four containers of sodium borate processing at the same time. Cap and shake each jug vigorously. Let the solution rest for 24 hours.

3) Pour off the clear sodium borate solution into the labelled red carboy being careful not to let any of the undissolved sodium borate escape out of the jug(s).

4) If you need to make more sodium borate solution, then refill the sodium borate jugs with more distilled water (the distilled water that had to be poured off to make room for the powder could be used for this) and proceed as before.

5) Save the jugs with undissolved sodium borate for the people on the next cruise to use as mixing containers.

Preservation Instructions

Please copy and post the instructions for the formaldehyde preservation of 8 oz. and 32 oz. plankton samples as close to the preservation area as possible.

TO PRESERVE AN 8 OZ. PLANKTON SAMPLE ADD:

12.5 ML FORMALDEHYDE

5 ML SODIUM BORATE

AND COMPLETE THE SAMPLE VOLUME WITH SEAWATER TO THE SHOULDER OF THE JAR.

TO PRESERVE A 32 OZ. PLANKTON SAMPLE ADD:

50 ML FORMALDEHYDE

20 ML SODIUM BORATE

AND COMPLETE THE SAMPLE VOLUME WITH SEAWATER TO THE SHOULDER OF THE JAR.

Standard Operating Procedures - 95% Ethanol

Chemical Name: 95% Ethanol
UN Number: 1170

Hazard Ratings: (on a scale of 0 to 4)

Health (blue): 3 Flammability (red): 3

Reactivity (yellow): 1 Special (white):

Personal Protection Gear Needed
*gloves
*goggles or face shield when pouring

Standard Operating Procedures - 95% Ethanol (cont'd)

Special Handling Instructions

* Keep away from heat, flame, and other potential ignition sources.
* Store in a well ventilated area or in a flammable cabinet.

First Aid

* If swallowed, give large amounts of drinking water and induce vomitting.
* If vapors inhaled, get out into fresh air immediately. Give oxygen if breathing is difficult.
* If spilled on skin or splashed in eyes, flush with water for at least 15 minutes.

Spill Cleanup Procedures

Absorb ethanol with 3M Sorbent Pads and allow to dry in a well ventilated area away from ignition source.

Deactivation/Disposal Procedures At Sea

Use 3M Sorbent Pads to absorb the ethanol. Put used pads outside to dry (secure from blowing overboard and exposure to flame). Once dry, the pads may be reused or burned.

Standard Operating Procedures - 95% Ethanol (cont'd)

Shipping Procedures and Restrictions

Due to the flammability rating of 95% ethanol, this chemical can not be shipped by air. Transportation by barge or land vehicle will require the ethanol container to be over-packed with absorbent materials such as clumping kitty litter or shredded paper. Include MSDS and the UN number with the shipment for reference in the event of a spill.

Standard Operating Procedures - 37% Formaldehyde

Chemical Name: 37% Formaldehyde
UN Number: 1198

Hazard Ratings: (on a scale of 0 to 4)

Health (blue): 3 Flammability (red): 2

Reactivity (yellow): 2 Special (white):

Personal Protection Gear Needed
*gloves
*respirator (half-mask)
*goggles or face shield

Standard Operating Procedures - 37% Formaldehyde (cont'd)

Special Handling Instructions

* If a ventilation hood is not available, then pouring of chemical must be done outside. At least two people should be involved with large chemical transfers in case of an emergency.
* Chemical must be stored at temperatures above 15° c to prevent polymerization of paraformaldehyde.

First Aid

* If swallowed, give large amounts of drinking water and induce vomitting.
*If vapors inhaled, get out into fresh air immediately. Give oxygen if breathing is difficult.
* If spilled on skin or splashed in eyes, flush with water for at least 15 minutes.

Spill Cleanup Procedures

For small spills (500 - 1000 ml):

Cover spill quickly with a pile of Polyform-F or absorb liquid with a Fan Pad and spray on extra Formalex to deactivate and absorb chemical. Let material sit for 10 - 15 minutes. Sweep up and dispose of materials in garbage.

For large spills (1000 ml - ?):

Use a combination of Polyform-F, Fan Pads and Formalex as quickly as possible to contain spill and deactivate it. Vacate area and try to ventilate room, if possible.

Standard Operating Procedures - 37% Formaldehyde (cont'd)

Deactivation/Disposal Procedures At Sea

*Polyform-F comes in bead form and should be used in a 1:1 ratio to insure proper chemical deactivation of small spills.

*Formalex is a pink liquid that is to be used in a 1:1 ratio to insure proper chemical deactivation. Formalex should also be used in conjunction with Fan Pads to stop and deactivate large spills.

*Fan Pads may be used to absorb small spills alone but these pads work best when used with Formalex to immediately control the vapor layer.

Shipping Procedures and Restrictions

37% formaldehyde cannot be ship by air due to its flammability rating.

All quantities should be over-packed with absorbency material in case the original container is damaged. When shipping by barge or land, labels are not required for quantities under 110 gallons by D.O.T. but the container should have MSDS and the UN number readily available.

Standard Operating Procedures - 10% Formalin

Chemical Name: 10% Formalin
UN Number: 1198

Hazard Ratings: (on a scale of 0 to 4)

Health (blue): 3 Flammability (red): 0

Reactivity (yellow): 0 Special (white):

Personal Protection Gear Needed
*gloves
*respirator (half-mask)
*goggles or face shield

Standard Operating Procedures - 10% Formalin (cont'd)

Special Handling Instructions

* If a ventilation hood is not available, then pouring of chemical must be done outside. At least two people should be involved with large chemical transfers in case of an emergency.
* Chemical must be stored at temperatures above 15° c to prevent polymerization of paraformaldehyde.

First Aid

* If swallowed, give large amounts of drinking water and induce vomitting.
*If vapors inhaled, get out into fresh air immediately. Give oxygen if breathing is difficult.
* If spilled on skin or splashed in eyes, flush with water for at least 15 minutes.

Spill Cleanup Procedures

For small spills (500-1000 ml):

Cover spill quickly with a pile of Polyform-F or absorb liquid with a Fan Pad and spray on extra Formalex to deactivate and absorb chemical. Let material sit for 10 - 15 minutes. Sweep up and dispose of materials in garbage.

For large spills (1000 ml - ?):

Use a combination of Polyform-F, Fan Pads and Formalex as quickly as possible to contain spill and deactivate it. Vacate area and try to ventilate room, if possible.

Standard Operating Procedures - 10% Formalin (cont'd)

Deactivation/Disposal Procedures At Sea

*Polyform-F comes in bead form and should be used in a 1:4 ratio to insure proper chemical deactivation of small spills.

*Formalex is a pink liquid that is to be used in a 1:4 ratio to insure proper chemical deactivation. Formalex should also be used in conjunction with Fan Pads to stop and deactivate large spills.

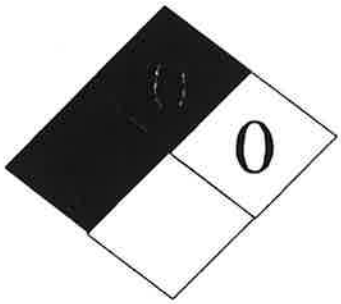
*Fan Pads may be used to absorb small spills alone but these pads work best when used with Formalex to immediately control the vapor layer.

Shipping Procedures and Restrictions

10% formalin may be shipped by air.

All quantities should be over-packed with absorbency material in case the original container is damaged. When shipping, labels are not required for quantities under 1000 lbs by D.O.T. but the container should have MSDS and the UN number readily available.

Standard Operating Procedures - 5% Formalin



Chemical Name: 5% Formalin
UN Number: 1198

Hazard Ratings: (on a scale of 0 to 4)

Health (blue): 3 Flammability (red): 0

Reactivity (yellow): 0 Special (white):

Personal Protection Gear Needed
*gloves
*respirator (half-mask)
*goggles or face shield

Standard Operating Procedures - 5% Formalin (cont'd)

Special Handling Instructions

* If a ventilation hood is not available, then pouring of chemical must be done outside. At least two people should be involved with large chemical transfers in case of an emergency.
* Chemical must be stored at temperatures above 15° c to prevent polymerization of paraformaldehyde.

First Aid

* If swallowed, give large amounts of drinking water and induce vomitting.
*If vapors inhaled, get out into fresh air immediately. Give oxygen if breathing is difficult.
* If spilled on skin or splashed in eyes, flush with water for at least 15 minutes.

Spill Cleanup Procedures

For small spills (500-1000 ml):

Cover spill quickly with a pile of Polyform-F or absorb liquid with a Fan Pad and spray on extra Formalex to deactivate and absorb chemical. Let material sit for 10 - 15 minutes. Sweep up and dispose of materials in garbage.

For large spills (1000 ml - ?):

Use a combination of Polyform-F, Fan Pads and Formalex as quickly as possible to contain spill and deactivate it. Vacate area and try to ventilate room, if possible.

Standard Operating Procedures - 5% Formalin (cont'd)

Deactivation/Disposal Procedures At Sea

*Polyform-F comes in bead form and should be used in a 1:4 ratio to insure proper chemical deactivation of small spills.

*Formalex is a pink liquid that is to be used in a 1:4 ratio to insure proper chemical deactivation. Formalex should also be used in conjunction with Fan Pads to stop and deactivate large spills.

*Fan Pads may be used to absorb small spills alone but these pads work best when used with Formalex to immediately control the vapor layer.

Shipping Procedures and Restrictions

5% formalin may be shipped by air.

All quantities should be over-packed with absorbency material in case the original container is damaged. When shipping, labels are not required for quantities under 1000 lbs by D.O.T. but the container should have MSDS and the UN number readily available.

Vessel Chemical Inventory Form

The following listing includes all hazardous chemicals scheduled for loading aboard NOAA R/V_____ to be used during cruise number _____.

planned chemicals	clean-up material	vol. chem loaded	amount used	amount removed	stored

1) chemicals and clean-up supplies loading supervised by _____(science party rep.)

2) chemicals properly stored before team departure (if applicable) _____(vessel rep.)

3) chemicals removed or accounted for _____(science rep.)

1h30b

Section: MICROSCOPES
List of Contents

INSTRUCTIONS FOR SETTING UP MICROSCOPES

After removing equipment from the box, loosen the knob securing the optics carrier to the column and lift the carrier off the column. Put a light transmission box in place on the stage - line up the two silver pegs on the box with the holes on the stage. You will need to apply a little pressure to seat it. Remove the stage clips and replace the solid round plate on the box with one of the clear glass plates (wrapped up in a plastic bag). Keep the stage clips in the plastic bag. Slide one of the plexiglass plates onto the column on top of the light box. Slide the optics carrier onto the column and tighten the screw. Get two of the eyepieces, making sure one of them is marked "ocular micrometer" and place on the optics carrier (please don't lose the black plugs you removed from the eye stems - place these into the clear plastic eyepiece containers). Position the eyepiece with the micrometer as you prefer (vertical or horizontal) and tighten the screws on both. Adjust the focus, connect the transformer box, and you're set!

The microscope stand must be mounted onto a piece of plywood so it can be secured to the counter. The holes in the bottom of the stand take 5/16" screws. The stand is aluminum so please take care not to strip the threads. Also, the plexiglass plate may have to be bungeed down so it won't swing around.

REPACKING

Remove the plywood base from the bottom of the stand. Reverse the steps for setting up the scopes, making sure you repack the glass stage plates and eyepieces. To remove the light box, you'll have to wiggle it a bit to work it loose. Slide the optics carrier all the way down the column and tighten the screw. Place the scopes in the shipping container with the bottoms of the stands next to the hinges on the box and the scopes facing inwards - the black knob should be resting on the foam. Wrap the eyepiece containers and plexiglass plates in the bubble wrap and repack all of the equipment (hint: put transformers at the top of the scopes next to the foam and place the light boxes on the inside of the column with the round plate facing in). The rest of the equipment goes mostly in the center. Place the beige foam over the parts in the middle of the box and shut the lid.

EQUIPMENT LIST

2 stands with columns
2 optics carriers with lights
2 transmitted light boxes
2 transformers
2 transformer electric cords
2 clear glass stage plates
2 white/black stage plates
4 stage clips
2 plexiglass plates
2 spare light bulbs (6V 10W)
4 eyepieces (2 with ocular micrometer)
4 black eye stem plugs
1 owner's manual

Info. provided by: D. Blood

9-Mar-95

ZEISS STEMI-2000

MULT		6.5 x 1.5873	8.0 x 1.25	10.0 x 1.0	12.5 x 0.8	16.0 x 0.625	20.0 x 0.5	25.0 x 0.4	32.0 x 0.3096	40.0 x 0.2326
0.1	=	0.1587	0.1250	0.1000	0.0800	0.0625	0.0500	0.0400	0.0310	0.0233
0.2	=	0.3175	0.2500	0.2000	0.1600	0.1250	0.1000	0.0800	0.0619	0.0465
0.3	=	0.4762	0.3750	0.3000	0.2400	0.1875	0.1500	0.1200	0.0929	0.0698
0.4	=	0.6349	0.5000	0.4000	0.3200	0.2500	0.2000	0.1600	0.1238	0.0930
0.5	=	0.7937	0.6250	0.5000	0.4000	0.3125	0.2500	0.2000	0.1548	0.1163
0.6	=	0.9524	0.7500	0.6000	0.4800	0.3750	0.3000	0.2400	0.1858	0.1396
0.7	=	1.1111	0.8750	0.7000	0.5600	0.4375	0.3500	0.2800	0.2167	0.1628
0.8	=	1.2698	1.0000	0.8000	0.6400	0.5000	0.4000	0.3200	0.2477	0.1861
0.9	=	1.4286	1.1250	0.9000	0.7200	0.5625	0.4500	0.3600	0.2786	0.2093
1	=	1.5873	1.2500	1.0000	0.8000	0.6250	0.5000	0.4000	0.3096	0.2326
1.1	=	1.7460	1.3750	1.1000	0.8800	0.6875	0.5500	0.4400	0.3406	0.2559
1.2	=	1.9048	1.5000	1.2000	0.9600	0.7500	0.6000	0.4800	0.3715	0.2791
1.3	=	2.0635	1.6250	1.3000	1.0400	0.8125	0.6500	0.5200	0.4025	0.3024
1.4	=	2.2222	1.7500	1.4000	1.1200	0.8750	0.7000	0.5600	0.4334	0.3256
1.5	=	2.3810	1.8750	1.5000	1.2000	0.9375	0.7500	0.6000	0.4644	0.3489
1.6	=	2.5397	2.0000	1.6000	1.2800	1.0000	0.8000	0.6400	0.4954	0.3722
1.7	=	2.6984	2.1250	1.7000	1.3600	1.0625	0.8500	0.6800	0.5263	0.3954
1.8	=	2.8571	2.2500	1.8000	1.4400	1.1250	0.9000	0.7200	0.5573	0.4187
1.9	=	3.0159	2.3750	1.9000	1.5200	1.1875	0.9500	0.7600	0.5882	0.4419
2	=	3.1746	2.5000	2.0000	1.6000	1.2500	1.0000	0.8000	0.6192	0.4652
2.1	=	3.3333	2.6250	2.1000	1.6800	1.3125	1.0500	0.8400	0.6502	0.4885
2.2	=	3.4921	2.7500	2.2000	1.7600	1.3750	1.1000	0.8800	0.6811	0.5117
2.3	=	3.6508	2.8750	2.3000	1.8400	1.4375	1.1500	0.9200	0.7121	0.5350
2.4	=	3.8095	3.0000	2.4000	1.9200	1.5000	1.2000	0.9600	0.7430	0.5582
2.5	=	3.9683	3.1250	2.5000	2.0000	1.5625	1.2500	1.0000	0.7740	0.5815
2.6	=	4.1270	3.2500	2.6000	2.0800	1.6250	1.3000	1.0400	0.8050	0.6048
2.7	=	4.2857	3.3750	2.7000	2.1600	1.6875	1.3500	1.0800	0.8359	0.6280
2.8	=	4.4444	3.5000	2.8000	2.2400	1.7500	1.4000	1.1200	0.8669	0.6513
2.9	=	4.6032	3.6250	2.9000	2.3200	1.8125	1.4500	1.1600	0.8978	0.6745
3	=	4.7619	3.7500	3.0000	2.4000	1.8750	1.5000	1.2000	0.9288	0.6978
3.1	=	4.9206	3.8750	3.1000	2.4800	1.9375	1.5500	1.2400	0.9598	0.7211
3.2	=	5.0794	4.0000	3.2000	2.5600	2.0000	1.6000	1.2800	0.9907	0.7443
3.3	=	5.2381	4.1250	3.3000	2.6400	2.0625	1.6500	1.3200	1.0217	0.7676
3.4	=	5.3968	4.2500	3.4000	2.7200	2.1250	1.7000	1.3600	1.0526	0.7908
3.5	=	5.5556	4.3750	3.5000	2.8000	2.1875	1.7500	1.4000	1.0836	0.8141
3.6	=	5.7143	4.5000	3.6000	2.8800	2.2500	1.8000	1.4400	1.1146	0.8374
3.7	=	5.8730	4.6250	3.7000	2.9600	2.3125	1.8500	1.4800	1.1455	0.8606

ZEISS STEMI-2000

MULT		6.5 x 1.5873	8.0 x 1.25	10.0 x 1.0	12.5 x 0.8	16.0 x 0.625	20.0 x 0.5	25.0 x 0.4	32.0 x 0.3096	40.0 x 0.2326
3.8	=	6.0317	4.7500	3.8000	3.0400	2.3750	1.9000	1.5200	1.1765	0.8839
3.9	=	6.1905	4.8750	3.9000	3.1200	2.4375	1.9500	1.5600	1.2074	0.9071
4	=	6.3492	5.0000	4.0000	3.2000	2.5000	2.0000	1.6000	1.2384	0.9304
4.1	=	6.5079	5.1250	4.1000	3.2800	2.5625	2.0500	1.6400	1.2694	0.9537
4.2	=	6.6667	5.2500	4.2000	3.3600	2.6250	2.1000	1.6800	1.3003	0.9769
4.3	=	6.8254	5.3750	4.3000	3.4400	2.6875	2.1500	1.7200	1.3313	1.0002
4.4	=	6.9841	5.5000	4.4000	3.5200	2.7500	2.2000	1.7600	1.3622	1.0234
4.5	=	7.1429	5.6250	4.5000	3.6000	2.8125	2.2500	1.8000	1.3932	1.0467
4.6	=	7.3016	5.7500	4.6000	3.6800	2.8750	2.3000	1.8400	1.4242	1.0700
4.7	=	7.4603	5.8750	4.7000	3.7600	2.9375	2.3500	1.8800	1.4551	1.0932
4.8	=	7.6190	6.0000	4.8000	3.8400	3.0000	2.4000	1.9200	1.4861	1.1165
4.9	=	7.7778	6.1250	4.9000	3.9200	3.0625	2.4500	1.9600	1.5170	1.1397
5	=	7.9365	6.2500	5.0000	4.0000	3.1250	2.5000	2.0000	1.5480	1.1630
5.1	=	8.09523	6.375	5.1	4.08	3.1875	2.5500	2.0400	1.5790	1.1863
5.2	=	8.2540	6.5000	5.2000	4.1600	3.2500	2.6000	2.0800	1.6099	1.2095
5.3	=	8.4127	6.6250	5.3000	4.2400	3.3125	2.6500	2.1200	1.6409	1.2328
5.4	=	8.5714	6.7500	5.4000	4.3200	3.3750	2.7000	2.1600	1.6718	1.2560
5.5	=	8.7302	6.8750	5.5000	4.4000	3.4375	2.7500	2.2000	1.7028	1.2793
5.6	=	8.8889	7.0000	5.6000	4.4800	3.5000	2.8000	2.2400	1.7338	1.3026
5.7	=	9.0476	7.1250	5.7000	4.5600	3.5625	2.8500	2.2800	1.7647	1.3258
5.8	=	9.2063	7.2500	5.8000	4.6400	3.6250	2.9000	2.3200	1.7957	1.3491
5.9	=	9.3651	7.3750	5.9000	4.7200	3.6875	2.9500	2.3600	1.8266	1.3723
6	=	9.5238	7.5000	6.0000	4.8000	3.7500	3.0000	2.4000	1.8576	1.3956
6.1	=	9.6825	7.6250	6.1000	4.8800	3.8125	3.0500	2.4400	1.8886	1.4189
6.2	=	9.8413	7.7500	6.2000	4.9600	3.8750	3.1000	2.4800	1.9195	1.4421
6.3	=	10.0000	7.8750	6.3000	5.0400	3.9375	3.1500	2.5200	1.9505	1.4654
6.4	=	10.1587	8.0000	6.4000	5.1200	4.0000	3.2000	2.5600	1.9814	1.4886
6.5	=	10.3175	8.1250	6.5000	5.2000	4.0625	3.2500	2.6000	2.0124	1.5119
6.6	=	10.4762	8.2500	6.6000	5.2800	4.1250	3.3000	2.6400	2.0434	1.5352
6.7	=	10.6349	8.3750	6.7000	5.3600	4.1875	3.3500	2.6800	2.0743	1.5584
6.8	=	10.7936	8.5000	6.8000	5.4400	4.2500	3.4000	2.7200	2.1053	1.5817
6.9	=	10.9524	8.6250	6.9000	5.5200	4.3125	3.4500	2.7600	2.1362	1.6049
7	=	11.1111	8.7500	7.0000	5.6000	4.3750	3.5000	2.8000	2.1672	1.6282
7.1	=	11.2698	8.8750	7.1000	5.6800	4.4375	3.5500	2.8400	2.1982	1.6515
7.2	=	11.4286	9.0000	7.2000	5.7600	4.5000	3.6000	2.8800	2.2291	1.6747
7.3	=	11.5873	9.1250	7.3000	5.8400	4.5625	3.6500	2.9200	2.2601	1.6980
7.4	=	11.7460	9.2500	7.4000	5.9200	4.6250	3.7000	2.9600	2.2910	1.7212

ZEISS STEMI-2000

MULT		6.5 x 1.5873	8.0 x 1.25	10.0 x 1.0	12.5 x 0.8	16.0 x 0.625	20.0 x 0.5	25.0 x 0.4	32.0 x 0.3096	40.0 x 0.2326
7.5	=	11.9048	9.3750	7.5000	6.0000	4.6875	3.7500	3.0000	2.3220	1.7445
7.6	=	12.0635	9.5000	7.6000	6.0800	4.7500	3.8000	3.0400	2.3530	1.7678
7.7	=	12.2222	9.6250	7.7000	6.1600	4.8125	3.8500	3.0800	2.3839	1.7910
7.8	=	12.3809	9.7500	7.8000	6.2400	4.8750	3.9000	3.1200	2.4149	1.8143
7.9	=	12.5397	9.8750	7.9000	6.3200	4.9375	3.9500	3.1600	2.4458	1.8375
8	=	12.6984	10.0000	8.0000	6.4000	5.0000	4.0000	3.2000	2.4768	1.8608
8.1	=	12.8571	10.1250	8.1000	6.4800	5.0625	4.0500	3.2400	2.5078	1.8841
8.2	=	13.0159	10.2500	8.2000	6.5600	5.1250	4.1000	3.2800	2.5387	1.9073
8.3	=	13.1746	10.3750	8.3000	6.6400	5.1875	4.1500	3.3200	2.5697	1.9306
8.4	=	13.3333	10.5000	8.4000	6.7200	5.2500	4.2000	3.3600	2.6006	1.9538
8.5	=	13.4921	10.6250	8.5000	6.8000	5.3125	4.2500	3.4000	2.6316	1.9771
8.6	=	13.6508	10.7500	8.6000	6.8800	5.3750	4.3000	3.4400	2.6626	2.0004
8.7	=	13.8095	10.8750	8.7000	6.9600	5.4375	4.3500	3.4800	2.6935	2.0236
8.8	=	13.9682	11.0000	8.8000	7.0400	5.5000	4.4000	3.5200	2.7245	2.0469
8.9	=	14.1270	11.1250	8.9000	7.1200	5.5625	4.4500	3.5600	2.7554	2.0701
9	=	14.2857	11.2500	9.0000	7.2000	5.6250	4.5000	3.6000	2.7864	2.0934
9.1	=	14.4444	11.3750	9.1000	7.2800	5.6875	4.5500	3.6400	2.8174	2.1167
9.2	=	14.6032	11.5000	9.2000	7.3600	5.7500	4.6000	3.6800	2.8483	2.1399
9.3	=	14.7619	11.6250	9.3000	7.4400	5.8125	4.6500	3.7200	2.8793	2.1632
9.4	=	14.9206	11.7500	9.4000	7.5200	5.8750	4.7000	3.7600	2.9102	2.1864
9.5	=	15.0794	11.8750	9.5000	7.6000	5.9375	4.7500	3.8000	2.9412	2.2097
9.6	=	15.2381	12.0000	9.6000	7.6800	6.0000	4.8000	3.8400	2.9722	2.2330
9.7	=	15.3968	12.1250	9.7000	7.7600	6.0625	4.8500	3.8800	3.0031	2.2562
9.8	=	15.5555	12.2500	9.8000	7.8400	6.1250	4.9000	3.9200	3.0341	2.2795
9.9	=	15.7143	12.3750	9.9000	7.9200	6.1875	4.9500	3.9600	3.0650	2.3027
10	=	15.8730	12.5000	10.0000	8.0000	6.2500	5.0000	4.0000	3.0960	2.3260

ZEISS STEMI-2000 C

MULT		6.5 x 1.6	8.0 x 1.25	10.0 x 1.0	12.5 x 0.8064	16.0 x 0.625	20.0 x 0.5	25.0 x 0.4	32.0 x 0.3125	40.0 x 0.25
0.1	=	0.1600	0.1250	0.1000	0.0806	0.0625	0.0500	0.0400	0.0313	0.0250
0.2	=	0.3200	0.2500	0.2000	0.1613	0.1250	0.1000	0.0800	0.0625	0.0500
0.3	=	0.4800	0.3750	0.3000	0.2419	0.1875	0.1500	0.1200	0.0938	0.0750
0.4	=	0.6400	0.5000	0.4000	0.3226	0.2500	0.2000	0.1600	0.1250	0.1000
0.5	=	0.8000	0.6250	0.5000	0.4032	0.3125	0.2500	0.2000	0.1563	0.1250
0.6	=	0.9600	0.7500	0.6000	0.4838	0.3750	0.3000	0.2400	0.1875	0.1500
0.7	=	1.1200	0.8750	0.7000	0.5645	0.4375	0.3500	0.2800	0.2188	0.1750
0.8	=	1.2800	1.0000	0.8000	0.6451	0.5000	0.4000	0.3200	0.2500	0.2000
0.9	=	1.4400	1.1250	0.9000	0.7258	0.5625	0.4500	0.3600	0.2813	0.2250
1	=	1.6000	1.2500	1.0000	0.8064	0.6250	0.5000	0.4000	0.3125	0.2500
1.1	=	1.7600	1.3750	1.1000	0.8870	0.6875	0.5500	0.4400	0.3438	0.2750
1.2	=	1.9200	1.5000	1.2000	0.9677	0.7500	0.6000	0.4800	0.3750	0.3000
1.3	=	2.0800	1.6250	1.3000	1.0483	0.8125	0.6500	0.5200	0.4063	0.3250
1.4	=	2.2400	1.7500	1.4000	1.1290	0.8750	0.7000	0.5600	0.4375	0.3500
1.5	=	2.4000	1.8750	1.5000	1.2096	0.9375	0.7500	0.6000	0.4688	0.3750
1.6	=	2.5600	2.0000	1.6000	1.2902	1.0000	0.8000	0.6400	0.5000	0.4000
1.7	=	2.7200	2.1250	1.7000	1.3709	1.0625	0.8500	0.6800	0.5313	0.4250
1.8	=	2.8800	2.2500	1.8000	1.4515	1.1250	0.9000	0.7200	0.5625	0.4500
1.9	=	3.0400	2.3750	1.9000	1.5322	1.1875	0.9500	0.7600	0.5938	0.4750
2	=	3.2000	2.5000	2.0000	1.6128	1.2500	1.0000	0.8000	0.6250	0.5000
2.1	=	3.3600	2.6250	2.1000	1.6934	1.3125	1.0500	0.8400	0.6563	0.5250
2.2	=	3.5200	2.7500	2.2000	1.7741	1.3750	1.1000	0.8800	0.6875	0.5500
2.3	=	3.6800	2.8750	2.3000	1.8547	1.4375	1.1500	0.9200	0.7188	0.5750
2.4	=	3.8400	3.0000	2.4000	1.9354	1.5000	1.2000	0.9600	0.7500	0.6000
2.5	=	4.0000	3.1250	2.5000	2.0160	1.5625	1.2500	1.0000	0.7813	0.6250
2.6	=	4.1600	3.2500	2.6000	2.0966	1.6250	1.3000	1.0400	0.8125	0.6500
2.7	=	4.3200	3.3750	2.7000	2.1773	1.6875	1.3500	1.0800	0.8438	0.6750
2.8	=	4.4800	3.5000	2.8000	2.2579	1.7500	1.4000	1.1200	0.8750	0.7000
2.9	=	4.6400	3.6250	2.9000	2.3386	1.8125	1.4500	1.1600	0.9063	0.7250
3	=	4.8000	3.7500	3.0000	2.4192	1.8750	1.5000	1.2000	0.9375	0.7500
3.1	=	4.9600	3.8750	3.1000	2.4998	1.9375	1.5500	1.2400	0.9688	0.7750
3.2	=	5.1200	4.0000	3.2000	2.5805	2.0000	1.6000	1.2800	1.0000	0.8000
3.3	=	5.2800	4.1250	3.3000	2.6611	2.0625	1.6500	1.3200	1.0313	0.8250
3.4	=	5.4400	4.2500	3.4000	2.7418	2.1250	1.7000	1.3600	1.0625	0.8500
3.5	=	5.6000	4.3750	3.5000	2.8224	2.1875	1.7500	1.4000	1.0938	0.8750
3.6	=	5.7600	4.5000	3.6000	2.9030	2.2500	1.8000	1.4400	1.1250	0.9000
3.7	=	5.9200	4.6250	3.7000	2.9837	2.3125	1.8500	1.4800	1.1563	0.9250

ZEISS STEMI-2000 C

MULT		6.5 x 1.6	8.0 x 1.25	10.0 x 1.0	12.5 x 0.8064	16.0 x 0.625	20.0 x 0.5	25.0 x 0.4	32.0 x 0.3125	40.0 x 0.25
3.8	=	6.0800	4.7500	3.8000	3.0643	2.3750	1.9000	1.5200	1.1875	0.9500
3.9	=	6.2400	4.8750	3.9000	3.1450	2.4375	1.9500	1.5600	1.2188	0.9750
4	=	6.4000	5.0000	4.0000	3.2256	2.5000	2.0000	1.6000	1.2500	1.0000
4.1	=	6.5600	5.1250	4.1000	3.3062	2.5625	2.0500	1.6400	1.2813	1.0250
4.2	=	6.7200	5.2500	4.2000	3.3869	2.6250	2.1000	1.6800	1.3125	1.0500
4.3	=	6.8800	5.3750	4.3000	3.4675	2.6875	2.1500	1.7200	1.3438	1.0750
4.4	=	7.0400	5.5000	4.4000	3.5482	2.7500	2.2000	1.7600	1.3750	1.1000
4.5	=	7.2000	5.6250	4.5000	3.6288	2.8125	2.2500	1.8000	1.4063	1.1250
4.6	=	7.3600	5.7500	4.6000	3.7094	2.8750	2.3000	1.8400	1.4375	1.1500
4.7	=	7.5200	5.8750	4.7000	3.7901	2.9375	2.3500	1.8800	1.4688	1.1750
4.8	=	7.6800	6.0000	4.8000	3.8707	3.0000	2.4000	1.9200	1.5000	1.2000
4.9	=	7.8400	6.1250	4.9000	3.9514	3.0625	2.4500	1.9600	1.5313	1.2250
5	=	8.0000	6.2500	5.0000	4.0320	3.1250	2.5000	2.0000	1.5625	1.2500
5.1	=	8.16	6.375	5.1	4.11264	3.1875	2.5500	2.0400	1.5938	1.2750
5.2	=	8.3200	6.5000	5.2000	4.1933	3.2500	2.6000	2.0800	1.6250	1.3000
5.3	=	8.4800	6.6250	5.3000	4.2739	3.3125	2.6500	2.1200	1.6563	1.3250
5.4	=	8.6400	6.7500	5.4000	4.3546	3.3750	2.7000	2.1600	1.6875	1.3500
5.5	=	8.8000	6.8750	5.5000	4.4352	3.4375	2.7500	2.2000	1.7188	1.3750
5.6	=	8.9600	7.0000	5.6000	4.5158	3.5000	2.8000	2.2400	1.7500	1.4000
5.7	=	9.1200	7.1250	5.7000	4.5965	3.5625	2.8500	2.2800	1.7813	1.4250
5.8	=	9.2800	7.2500	5.8000	4.6771	3.6250	2.9000	2.3200	1.8125	1.4500
5.9	=	9.4400	7.3750	5.9000	4.7578	3.6875	2.9500	2.3600	1.8438	1.4750
6	=	9.6000	7.5000	6.0000	4.8384	3.7500	3.0000	2.4000	1.8750	1.5000
6.1	=	9.7600	7.6250	6.1000	4.9190	3.8125	3.0500	2.4400	1.9063	1.5250
6.2	=	9.9200	7.7500	6.2000	4.9997	3.8750	3.1000	2.4800	1.9375	1.5500
6.3	=	10.0800	7.8750	6.3000	5.0803	3.9375	3.1500	2.5200	1.9688	1.5750
6.4	=	10.2400	8.0000	6.4000	5.1610	4.0000	3.2000	2.5600	2.0000	1.6000
6.5	=	10.4000	8.1250	6.5000	5.2416	4.0625	3.2500	2.6000	2.0313	1.6250
6.6	=	10.5600	8.2500	6.6000	5.3222	4.1250	3.3000	2.6400	2.0625	1.6500
6.7	=	10.7200	8.3750	6.7000	5.4029	4.1875	3.3500	2.6800	2.0938	1.6750
6.8	=	10.8800	8.5000	6.8000	5.4835	4.2500	3.4000	2.7200	2.1250	1.7000
6.9	=	11.0400	8.6250	6.9000	5.5642	4.3125	3.4500	2.7600	2.1563	1.7250
7	=	11.2000	8.7500	7.0000	5.6448	4.3750	3.5000	2.8000	2.1875	1.7500
7.1	=	11.3600	8.8750	7.1000	5.7254	4.4375	3.5500	2.8400	2.2188	1.7750
7.2	=	11.5200	9.0000	7.2000	5.8061	4.5000	3.6000	2.8800	2.2500	1.8000
7.3	=	11.6800	9.1250	7.3000	5.8867	4.5625	3.6500	2.9200	2.2813	1.8250
7.4	=	11.8400	9.2500	7.4000	5.9674	4.6250	3.7000	2.9600	2.3125	1.8500

ZEISS STEMI-2000 C

MULT		6.5 x 1.6	8.0 x 1.25	10.0 x 1.0	12.5 x 0.8064	16.0 x 0.625	20.0 x 0.5	25.0 x 0.4	32.0 x 0.3125	40.0 x 0.25
7.5	=	12.0000	9.3750	7.5000	6.0480	4.6875	3.7500	3.0000	2.3438	1.8750
7.6	=	12.1600	9.5000	7.6000	6.1286	4.7500	3.8000	3.0400	2.3750	1.9000
7.7	=	12.3200	9.6250	7.7000	6.2093	4.8125	3.8500	3.0800	2.4063	1.9250
7.8	=	12.4800	9.7500	7.8000	6.2899	4.8750	3.9000	3.1200	2.4375	1.9500
7.9	=	12.6400	9.8750	7.9000	6.3706	4.9375	3.9500	3.1600	2.4688	1.9750
8	=	12.8000	10.0000	8.0000	6.4512	5.0000	4.0000	3.2000	2.5000	2.0000
8.1	=	12.9600	10.1250	8.1000	6.5318	5.0625	4.0500	3.2400	2.5313	2.0250
8.2	=	13.1200	10.2500	8.2000	6.6125	5.1250	4.1000	3.2800	2.5625	2.0500
8.3	=	13.2800	10.3750	8.3000	6.6931	5.1875	4.1500	3.3200	2.5938	2.0750
8.4	=	13.4400	10.5000	8.4000	6.7738	5.2500	4.2000	3.3600	2.6250	2.1000
8.5	=	13.6000	10.6250	8.5000	6.8544	5.3125	4.2500	3.4000	2.6563	2.1250
8.6	=	13.7600	10.7500	8.6000	6.9350	5.3750	4.3000	3.4400	2.6875	2.1500
8.7	=	13.9200	10.8750	8.7000	7.0157	5.4375	4.3500	3.4800	2.7188	2.1750
8.8	=	14.0800	11.0000	8.8000	7.0963	5.5000	4.4000	3.5200	2.7500	2.2000
8.9	=	14.2400	11.1250	8.9000	7.1770	5.5625	4.4500	3.5600	2.7813	2.2250
9	=	14.4000	11.2500	9.0000	7.2576	5.6250	4.5000	3.6000	2.8125	2.2500
9.1	=	14.5600	11.3750	9.1000	7.3382	5.6875	4.5500	3.6400	2.8438	2.2750
9.2	=	14.7200	11.5000	9.2000	7.4189	5.7500	4.6000	3.6800	2.8750	2.3000
9.3	=	14.8800	11.6250	9.3000	7.4995	5.8125	4.6500	3.7200	2.9062	2.3250
9.4	=	15.0400	11.7500	9.4000	7.5802	5.8750	4.7000	3.7600	2.9375	2.3500
9.5	=	15.2000	11.8750	9.5000	7.6608	5.9375	4.7500	3.8000	2.9687	2.3750
9.6	=	15.3600	12.0000	9.6000	7.7414	6.0000	4.8000	3.8400	3.0000	2.4000
9.7	=	15.5200	12.1250	9.7000	7.8221	6.0625	4.8500	3.8800	3.0312	2.4250
9.8	=	15.6800	12.2500	9.8000	7.9027	6.1250	4.9000	3.9200	3.0625	2.4500
9.9	=	15.8400	12.3750	9.9000	7.9834	6.1875	4.9500	3.9600	3.0937	2.4750
10	=	16.0000	12.5000	10.0000	8.0640	6.2500	5.0000	4.0000	3.1250	2.5000

Section: FORMS and LABELS
List of Contents

AGE-0 LENGTH FORM

Cruise:	
Station-Haul:	
Date Measured:	
Species:	
Sample Type:	
Length Type:	
Preserv.:	
Comments:	

Length (mm)	Frequency
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	
4	
5	
6	

Length (mm)	Frequency
7	
8	
9	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
0	
1	
2	
3	

FOCI CRUISE#_____

SHIP CRUISE#_____

CTD Cast Chlorophyll Sampling Log

Please fill in applicable columns at sea				These columns are completed in Seattle		
station	haul	sample depth	chl volume filtered	dilution	Fb	Fa

VESSEL: _____ PROJECT & LEG: _____ INITIALS: _____ CHECKED BY: _____ PAGE ____ of ____

CONSECUTIVE CAST NUMBER	LATITUDE DEG	LATITUDE MIN		LONGITUDE DEG	LONGITUDE MIN		DATE JD= DAY	DATE JD= MO	DATE JD= YR	TIME (GMT) HR	TIME (GMT) MIN	DRY BULB (° C)	WET BULB (° C)	BAR. (mb,integer)	SEA STATE	VISIBILITY	WIND DIRECTION	WIND SPEED (kts)	CLOUD (amt)	TYPE	WEATHER	BOTTOM DEPTH (m)	STA. NAME/ID
		.	N		.	W			9 5			.	.										

CTD

TYPE & SN _____

PRESS. SN _____

TEMP. SN _____

COND. SN _____

ATTACHMENTS:

LIGHT METER (√) _____

FLUOROMETER (√) _____

OTHER: _____

OTHER: _____

FILENAME:

REMARKS (include alternate station designation if applicable):

Position	Bot. #	Trip Depth	T-rack	TIME @ Depth	TIME @ Trip	Monitor Values Press.	Temp.	Salinity	Cond.	Fluor.	Sample Bottle Data ThermP	Avg. Tw	Sal.	Sal. Bot.#	Nutrient Bottle #	Chlor/ MZ	Other	Position
1																/		1
2																/		2
3																/		3
4																/		4
5																/		5
6																/		6
7																/		7
8																/		8
9																/		9
10																/		10
11																/		11
12																/		12

CTD CAST LOG FORM

Discrete Sample Database Entry Form

data entered

error checked

error correction completed

FOCI Cruise# _____ (e.g. 4MF04) Station _____ Haul ___ FOCI Station# _____ (e.g. III9 or IOX058) Alternate Station# _____ (e.g. CTD015 or MOC10P9)

Ship Cruise# _____ (e.g. MF0404) GM-Date _____ (e.g. 15sep97) GM-Time _____ Bottom Depth _____ m

Dlat _____ Mlat _____ ° N Dlong _____ Mlong _____ ° W

Haul Comments _____

wire out _____ m/min wire in _____ m/min Scientist Completing Form _____

Gear Types *Use abbreviations to fill in gear sections below (See FOCI Field Manual for definitions)*

20BON	CALVET	EASTERN	LIVE	NETFLUOR	ROPE	SHRIMP	TUCK3	BIOOTHER *
60BON	CAT	EBKG	MARIN	NEU	SATBUOY	SLED	VIDEOCTD	PHYOTHER *
ASOUND	CTD	IKMT	METH	NOR	SCANMAR	SM-CB	VIDEONET	*(must explain in haul comments)
ASCTD	CTDH	IKS	MOOR	RING8	SEDTRAP	TRANS	XBT	
BOTTLES	DIAM	LG-CB	MPS	RING	SHIPBUOY	TUCK1		

GEAR _____ Net _____ Mesh _____µm

Purpose *circle one*

gridpre pinksurv diel gear
grid juvsurv drift other*
gridpost adult phys

*(explain other in haul comments)

Performance *circle one*

good fail quest lost

explain in haul comments if not good

Flow Meter

Note Record only first five digits

Meter No. _____
Final Rev. _____
Initial Rev. _____
Total Rev. _____

Tow Times

	′	″
sinking	___	___
mess. net 0	___	___
at depth	___	___
haul in	___	___
mess. net 1	___	___
Total	___	

Depth

Min_____m Max_____m

Wire Out

Min_____m Max_____m

Wire angle at depth _____

Samples Collected *circle all that apply and enter number of samples where appropriate*

ABSORB	J-GUT	QTOWF
ADCP	J-LENGTH	QTOWS
A-GENET	J-OTO	RCOUNT E
A-GUT	J-WGHT	RCOUNT L
A-LENGTH	L-BIOCH	RECOVERY
A-OTO	L-GENET	RNA/DNA
ASOUND	L-GUT	SCANMAR
A-WGHT	L-HIST	SHRINK
BKG-CAL	LIVE	SSF
BLOOD	L-MUSC	STRIP
BRAIN	L-OTO	TSG
CAT	LUGOLS	VIDEOCTD
CHLAM	MERIST	VIDEONET
CHLOR	MZ	XBT
CTD	NETFLUOR	
DEPLOY	NUT	
DISCARD	OVARY	BIOOTHER
EBKG	PAR	PHYOTHER
EK500	PHYTOF	(must explain in haul or net comments)
FLUOR	POC	
J-GENET	PRED	

Net Comments _____

GEAR _____ Net _____ Mesh _____µm

Purpose *circle one*

gridpre pinksurv diel gear
grid juvsurv drift other*
gridpost adult phys

*(explain other in haul comments)

Performance *circle one*

good fail quest lost

explain in haul comments if not good

Flow Meter

Note Record only first five digits

Meter No. _____
Final Rev. _____
Initial Rev. _____
Total Rev. _____

Tow Times

	′	″
sinking	___	___
mess. net 0	___	___
at depth	___	___
haul in	___	___
mess. net 1	___	___
Total	___	

Depth

Min_____m Max_____m

Wire Out

Min_____m Max_____m

Wire angle at depth _____

Samples Collected *circle all that apply and enter number of samples where appropriate*

ABSORB	J-GUT	QTOWF
ADCP	J-LENGTH	QTOWS
A-GENET	J-OTO	RCOUNT E
A-GUT	J-WGHT	RCOUNT L
A-LENGTH	L-BIOCH	RECOVERY
A-OTO	L-GENET	RNA/DNA
ASOUND	L-GUT	SCANMAR
A-WGHT	L-HIST	SHRINK
BKG-CAL	LIVE	SSF
BLOOD	L-MUSC	STRIP
BRAIN	L-OTO	TSG
CAT	LUGOLS	VIDEOCTD
CHLAM	MERIST	VIDEONET
CHLOR	MZ	XBT
CTD	NETFLUOR	
DEPLOY	NUT	
DISCARD	OVARY	BIOOTHER
EBKG	PAR	PHYOTHER
EK500	PHYTOF	(must explain in haul or net comments)
FLUOR	POC	
J-GENET	PRED	

Net Comments _____

FOCI CRUISE#_____

SHIP CRUISE#_____

Flow-thru Chlorophyll Sampling Log

Please fill in applicable columns at sea						These columns are completed In Seattle	
station	haul	date (DDMMM)	time (GMT)	chl volume filtered	fluorometer reading	Fb	Fa

96CHLSHT.XLS
37 lines/page

1/10/96

HAUL-POSITION FORM

POSITION CARD

HAUL CARD

VESSEL (2 3 4) _____ CRUISE (6 7 8) HAUL (10 11 12)

YEAR (14 15) MONTH (16 17) DAY (18 19) YOUR NAME _____

	LATITUDE		LONGITUDE		
POSITION START...	(20 21 22) + DEGREE	(23 24 26 27) MIN.	(28 29 30 31) DEGREE	(32 33 35 36) MIN.	"+" = WEST "-" = EAST COL. 28 & 45
END.....	(37 38 39) +	(40 41 43 44)	(45 46 47 48)	(49 50 52 53)	

	RATE	FIRST READING	RATE	SECOND READING
LORAN START	(55 56)	(58 59 60 61 62 64 65)	(67 68)	(70 71 72 73 74 76 77)
LORAN END...	(79 80)	(82 83 84 85 86 88 89)	(91 92)	(94 95 96 97 98 100 101)

---------- DUP. COL. 1-36 FROM ABOVE

GEAR DEPTH WTD. AVG. (FM) (37 38 39 40) MIN _____ MAX _____

BOTTOM DEPTH WTD. AVG. (FM) (41 42 43 44) MIN _____ MAX _____

TIME STANDARD USED _____

EQUIL. HOUR (46 47) DURATION (HRS.) (48 49 51 52) TIME START _____ OUT _____

EQUILIBRIUM _____

DISTANCE FISHED (N.M.) (54 55 57 58) HAUL TYPE (60 61) HAUL _____

IN _____

STRATUM (62 63 64) WTD. AVG. TRACE DEPTH (FM) (65 66 67 68) MIN _____ MAX _____

DESCR. _____

WATER TEMPERATURES (DEGREES C.) SURFACE (70 71 73) GEAR (75 76 78) METHOD _____

BOTTOM TYPE (83 84) DESCR. _____

WIRE OUT (FM) (85 86 87 88) GEAR TYPE (94 95 96) DOOR + ACCES. (97 98 99)

PERFOR MANCE (103) _____ WEATHER, SEA CONDITIONS _____

REMARKS

DP-CJ1 83-01-15

SPECIMEN COLLECTION LABEL

National Marine Fisheries Service, Northwest and Alaska
Fisheries Center-7600 Sandpoint Way-Seattle, WA. 98115

VESSEL_____ CRUISE NUMBER_____ HAUL NUMBER_____

SPECIMEN NUMBER_____

STOMACH SAMPLE_____ TISSUE SAMPLE_____ RIGHT OVARY_____ LEFT OVARY_____

WHOLE ANIMAL_____ LENGTH (CM)_____ WEIGHT (GM)_____

SPECIES IDENTIFICATION_____

COMMENTS_____

_____

COLLECTOR'S INITIALS_____ PRESERVATIVE_____

Specimen Label

• use pencil

Inside Jar Label

• use pencil

Cruise: 8MF97 Date: 2JUN97

Sta. No.: _____ Gear: _____

Net No.: _____ Haul No.: _____ Mesh: _____

AFSC, 7600 Sand Point Way N.E., Seattle, WA 98115-0070

FOCI Label

• use pen!

NMFS / FOCI Seattle

Cruise:_____

Date:_____

Station:_____ Haul No:_____

Gear:_____

Depth:_____ Volume:_____

Net:_____ Mesh:_____

MICROZOOPLANKTON

DP-003 83-01-15

LENGTH-FREQUENCY FORM

VESSEL (1 2 3) ______ CRUISE (5 6 7) ______ HAUL (9 10 11) ______

DATE ______ TOTAL WEIGHT (LB.) ______ SUBSAMPLE WEIGHT (LB.) ______

SPECIES CODE (13 14 15 16 17) ______ SPECIES NAME ______

YOUR NAME ______ SUBSAMPLE TYPE (32) ______ LENGTH TYPE (IF NOT FORK LEN.) (33 34) ______

19 20 21 22 23	26 27 28	30	19 20 21 22 23	26 27 28	30	19 20 21 22 23	26 27 28	30
LENGTH IN MM.	FREQ-UENCY	SEX	LENGTH IN MM.	FREQ-UENCY	SEX	LENGTH IN MM.	FREQ-UENCY	SEX
0			0			0		
0			0			0		
0			0			0		
0			0			0		
0			0			0		
0			0			0		
0			0			0		
0			0			0		
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0			0			0		
0			0			0		
0			0			0		
0			0			0		

MOCNESS DSDB Entry Form

data checked

error checked

error correction completed

FOCI Cruise# _____ (e.g. 4MI94) Station _____ Haul ____ FOCI Station# _____ (e.g. H19 or FOX058) Alternate Station# _____ (e.g. CTD 015 or MOC 009)

Ship Cruise# _____ (e.g. MI94-04) Bottom Depth _____ m Gear _____

Haul Comments _____

_____

_____ Scientist Completing Form _____

NET 1

Mesh_____*um* GM-Date _____ (MM/DD/YY) GM-Time _____

record position when net opens Dlat _____ Mlat _____ ° N Dlong _____ Mlong _____ ° W

Min depth_____m Volume

Max depth_____m Filtered_____ (*recorded after processing*)

Net Comments_____

Purpose *circle one*

plnkpre juvpre diel
plnksurv juvsurv drift
plnkpost juvpost gear
other spE
(explain in net comments)

Performance *circle one*

good fail quest lost
explain in net comments if not good

Samples Collected *circle all that apply and enter number of samples where appropriate*

DISCARD	L-GUT	RCOUNTL
J-GENET	L-OTO	BIOOTHER
J-GUT	PRED	PHYOTHER
J-LENGTH	QTOWF	(must explain
J-OTO	QTOWS	in haul or net
J-WGHT	RCOUNTE	comments)

NET 2

Mesh_____*um* GM-Date _____ (MM/DD/YY) GM-Time _____

record position when net opens Dlat _____ Mlat _____ ° N Dlong _____ Mlong _____ ° W

Min depth_____m Volume

Max depth_____m Filtered_____ (*recorded after processing*)

Net Comments_____

Purpose *circle one*

plnkpre juvpre diel
plnksurv juvsurv drift
plnkpost juvpost gear
other spE
(explain in net comments)

Performance *circle one*

good fail quest lost
explain in net comments if not good

Samples Collected *circle all that apply and enter number of samples where appropriate*

DISCARD	L-GUT	RCOUNTL
J-GENET	L-OTO	BIOOTHER
J-GUT	PRED	PHYOTHER
J-LENGTH	QTOWF	(must explain
J-OTO	QTOWS	in haul or net
J-WGHT	RCOUNTE	comments)

NET 3

Mesh_____*um* GM-Date _____ (MM/DD/YY) GM-Time _____

record position when net opens Dlat _____ Mlat _____ ° N Dlong _____ Mlong _____ ° W

Min depth_____m Volume

Max depth_____m Filtered_____ (*recorded after processing*)

Net Comments_____

Purpose *circle one*

plnkpre juvpre diel
plnksurv juvsurv drift
plnkpost juvpost gear
other spE
(explain in net comments)

Performance *circle one*

good fail quest lost
explain in net comments if not good

Samples Collected *circle all that apply and enter number of samples where appropriate*

DISCARD	L-GUT	RCOUNTL
J-GENET	L-OTO	BIOOTHER
J-GUT	PRED	PHYOTHER
J-LENGTH	QTOWF	(must explain
J-OTO	QTOWS	in haul or net
J-WGHT	RCOUNTE	comments)

NET 4

Mesh_____*um* GM-Date _____ (MM/DD/YY) GM-Time _____

record position when net opens Dlat _____ Mlat _____ ° N Dlong _____ Mlong _____ ° W

Min depth_____m Volume

Max depth_____m Filtered_____ (*recorded after processing*)

Net Comments_____

Purpose *circle one*

plnkpre juvpre diel
plnksurv juvsurv drift
plnkpost juvpost gear
other spE
(explain in net comments)

Performance *circle one*

good fail quest lost
explain in net comments if not good

Samples Collected *circle all that apply and enter number of samples where appropriate*

DISCARD	L-GUT	RCOUNTL
J-GENET	L-OTO	BIOOTHER
J-GUT	PRED	PHYOTHER
J-LENGTH	QTOWF	(must explain
J-OTO	QTOWS	in haul or net
J-WGHT	RCOUNTE	comments)

GPO 791-212 2/96

The On-Deck ~~Catch~~ sampling Form is used to record catch composition according to gear-specific catch processing protocol. This form is also used to record the number of specimens, by taxa, used to fulfill each Special Study Requests. The Non-Subsample Weight plus the Subsample Weight are added together to give the total weight caught and are used, along with the Subsample Number to calculate the total number caught [Total Number = (Non-Sub Wt + Sub-Wt) * Sub-Num / Sub-Wt)]. Because weight units may either be grams or kilograms, it is crucial that these units be specified for each weight.

ON-DECK SAMPLING FORM – SPECIES COMPOSITION

Page _____ Of _____

Vessel _____ Cruise _____ Haul No. _____

Date _____ Haul Type --- Regular Other (circle) Surface (bucket) Temperature _____ C°

1. If the trawl sample was subsampled, check box here ☐ and then enter data and computations on back side of page.

2. If the same portion of all species was processed, enter the percent here ☐☐☐.☐ %

Otherwise enter percents for each species on next lines ↓

Species name and code	Non-sub-sample basket weights	Sub-sample basket weights	Sub-sample numbers	Percent

79-3-10

When data have been recorded on terminal, mark an 'X' here ◯

U.S. GOVERNMENT PRINTING OFFICE 1988—592-240

ON-DECK SAMPLING FORM – SUBSAMPLE CALCULATIONS

Vessel _____ Cruise _____ Haul No. _____

Split Weights	1.	2.	3.	4.	5.	Total
Dynamometer						
– Bag weight						
– Debris removed before subsampling						
= Animal Weight						

Calculation Of Percent Processed

1. In cases where the proportions of fish and crab processed are the same:

$$\text{Percent of fish and crab processed} = \frac{\text{weight of fish and crab processed}}{\text{total weight of catch}} \times 100\%$$

$$= \frac{\qquad}{\qquad} \times 100\%$$

$$= \boxed{\qquad\qquad\%}$$

2. In cases where some items in the catch are completely processed, but only a fraction of the fish are processed:

(a) Total weight of catch (A) = _____

(b) Weights of items completely processed: Crab = _____

Halibut = _____

Other = _____

Total (B) = _____

(c) Total weight of all items (including debris) processed in groundfish subsample (C) = _____

(d) Percent of fish processed $= \frac{C}{A-B} \times 100\% =$ $\boxed{\qquad\qquad\%}$

SAMPLE REQUEST FORM

This is intended to assist at-sea personnel correctly perform sample collection efficiently and in a consistent manner. If a Net tow, complete for each net. MOCNESS and CTD/Rosette samples use back page. Refer to the Field Manual and DSDB form for specific definitions, procedures, and format for abbreviations. If any sample, gear, or record keeping requirements differ in any way than what is described in the Field Manual, instructions should be noted here. Submit completed forms to Bill Rugen who will check them for completeness, etc. and forward them to the Chief Scientist.

Cruise : _____ Requestor's Name: _____

Chief Scientist: _____ Checked by Bill R. _____

Stations/Area to be Sampled: _____

_____

_____

Chemicals (include volume to be used): _____

Net Tows

GEAR _____ **Towing Target Depth:** _____

Haul Comments (if Gear is **Bioother** or **Phyother**): _____

Net 1: Net Mesh_____ Cod-end Mesh_____ Purpose Code_____

Samples Collected _____ Net Saved? Y / N

Net Comments (if Purpose is **spE** or **other**; if Sample is **Bioother** or **Phyother**): _____

Net 2: Net Mesh_____ Cod-end Mesh_____ Purpose Code_____

Samples Collected _____ Net Saved? Y / N

Net Comments (if Purpose is **spE** or **other**; if Sample is **Bioother** or **Phyother**): _____

Electronic Gear: CAT_____ EBKG_____ ScanMar_____ Furuno_____ Netflour_____ Videonet_____

Electronic Samples: CAT_____ EBKG_____ ScanMar_____ Furuno_____ Netflour_____ Videonet_____

GEAR _____ **Towing Target Depth:** _____

Haul Comments (if Gear is **Bioother** or **Phyother**): _____

Net 1: Net Mesh_____ Cod-end Mesh_____ Purpose Code_____

Samples Collected _____ Net Saved? Y / N

Net Comments (if Purpose is **spE** or **other**; if Sample is **Bioother** or **Phyother**): _____

Net 2: Net Mesh_____ Cod-end Mesh_____ Purpose Code_____

Samples Collected _____ Net Saved? Y / N

Net Comments (if Purpose is **spE** or **other**; if Sample is **Bioother** or **Phyother**): _____

Electronic Gear: CAT_____ EBKG_____ ScanMar_____ Furuno_____ Netflour_____ Videonet_____

Electronic Samples: CAT_____ EBKG_____ ScanMar_____ Furuno_____ Netflour_____ Videonet_____

Special Instructions: _____

_____

_____

_____

_____

Sample Request Form

MOCNESS Please give as much info as possible regarding MOCNESS tows (mesh size, nets to be saved, etc) , o attach instructions.

GEAR: CTD / CTDB / BOTTLES / VIDEOCTD (Circle) Cast Target Depth:_____

Station Nos.:			
MZ Depths			
Chlor Depths			
Nut Depths			
Other			
Electronic Samples	CTD____ Chlam_____ Flour_____ Par_____ VideoCTD_____ Other_____		

GEAR: CTD / CTDB / BOTTLES / VIDEOCTD (Circle) Cast Target Depth:_____

Station Nos.:			
MZ Depths			
Chlor Depths			
Nut Depths			
Other			
Electronic Samples	CTD____ Chlam_____ Flour_____ Par_____ VideoCTD_____ Other_____		

*Other Comments:*_____

SPECIMEN FORM

PAGE ____ OF ____

VESSEL (1 2 3) ______________________ CRUISE (5 6 7) HAUL (9 10 11)

STRATUM (13 14 15) SPECIES CODE (17 18 19 20 21) SPECIES NAME ______________________

FREQUENCY (36) 1 SUBSAMPLE TYPE (48) WEIGHT DETERMIN. (49) AGE STRUCTURE (50) AGE DETERMIN. (51)

MATURITY TABLE (59 60) YOUR NAME ______________________ DATE ______________

SEX (23)	MAT UR (25)	LENGTH IN MM. (28 29 30 31)	WEIGHT (GRAMS) (37 38 39 40 41)	AGE (45 46)	SPECIMEN NUMBER (53 54 55 56 57)	(62 63 64 65 66)	(68 69 70 71 72)

Section: MISCELLANEOUS
List of Contents

Common Formulas

Calibration Factor (Y)

$Y = a + b(X)$ where : X = revolutions / seconds, Y = meters / revolution

a = Intercept
b = Slope

i. e. : $Y = .275 + (-0.006)X$

Standard Haul Factors

$$SHF - A = \frac{(10 \times \text{Depth Fished})}{(\#\text{revs})(\text{mouth area})(\text{calib. factor})}$$

$$SHF - B = \frac{(1000)}{(\#\text{revs})(\text{mouth area})(\text{calib. factor})}$$

Catch

C / 10 m2 = (SHF−A)(# caught)

C / 1000 m3 = (SHF−B)(# caught)

MISC.

$$\text{Mean Density} = \frac{\sum (\text{C / 1000m3 / tow})}{\text{No. of hauls}} = \frac{\text{Arithmetic Mean}}{\text{No. of hauls}}$$

Volume Filtered = (#Revs)(Mouth area)(Calib. factor)

$$\text{Geometric Mean} = \text{antilog}\left(\frac{\sum \log((\text{C / 1000 m3 / tow}))}{\text{No. of positive hauls}}\right)$$

$$\text{Number in Area} = \sum((\text{C / 10m2})(\text{station area}))$$

Mouth Areas

Gear	Area (m2)	Gear	Area (m2)
1 – Neuston	0.075	9 – MOCNESS	1.0
2 – 60 cm Bongo	0.28274	12 – Lrg CB	0.05067
3 – 1 m Tucker	1.0	13 – Methot	5.16789
4 – IKMT	1.0	14 – 3 m Tucker	3.0
5 – Sled	1.0	15 – Calvet	0.04909
1 – 20 cm Bongo	0.03142		

Embryonic Development

The illustrations and duration table provided on the following pages have been derived for walleye pollock eggs from Shelikof Strait. It is best to use the Midpoint (h) column to estimate egg age. Stage 7 has the longest developmental duration so it will probably be the most prevalent in samples.

References:
Blood, D., A. C. Matarese, M. M. Yoklavich. 1994. Embryonic development of walleye pollock, *Theragra chalcogramma*, from Shelikof Strait, Gulf of Alaska. Fish. Bull., U.S. 92: 207-222.

Info. provided by: D. Blood

10-Mar-95

Table 3

Endpoint, midpoint, and duration in hours (h) of stage of development of *Theragra chalcogramma* eggs incubated at 3.8°, 5.7°, and 7.7°C.

	3.8°C			5.7°C			7.7°C		
Stage	Endpoint (h)	Midpoint (h)	Duration (h)	Endpoint (h)	Midpoint (h)	Duration (h)	Endpoint (h)	Midpoint (h)	Duration (h)
1	4.00	2.00	4.00	4.00	2.00	4.00	3.50	1.75	3.50
2	6.00	5.00	2.00	6.00	5.00	2.00	4.00	3.75	0.50
3	8.00	7.00	2.00	7.00	6.50	1.00	5.00	4.50	1.00
4	10.25	9.12	2.25	9.00	8.00	2.00	7.00	6.00	2.00
5	12.50	11.37	2.25	10.25	9.62	1.25	10.25	8.62	3.25
6	22.50	17.50	10.00	22.50	16.37	12.25	19.50	14.87	9.25
7	64.00	43.25	41.50	51.00	36.75	28.50	40.00	29.75	20.50
8	78.00	71.00	14.00	68.00	59.50	17.00	48.00	44.00	8.00
9	90.00	84.00	12.00	75.00	71.50	7.00	54.00	51.00	6.00
10	105.00	97.50	15.00	87.00	81.00	12.00	57.00	55.50	3.00
11	120.00	112.50	15.00	93.00	90.00	6.00	68.00	62.50	11.00
12	138.00	129.00	18.00	108.00	100.50	15.00	84.00	76.00	16.00
13	153.00	145.50	15.00	114.00	111.00	6.00	87.00	85.50	3.00
14	180.00	166.50	27.00	135.00	124.50	21.00	102.00	94.50	15.00
15	195.00	187.50	15.00	164.00	149.50	29.00	111.00	106.50	9.00
16	219.00	207.00	24.00	174.00	169.00	10.00	117.00	114.00	6.00
17	252.00	235.50	33.00	189.00	181.50	15.00	132.00	124.50	15.00
18	312.00	282.00	60.00	219.00	204.00	30.00	144.00	138.00	12.00
19	336.00	324.00	24.00	258.00	238.50	39.00	180.00	162.00	36.00
20	378.00	357.00	42.00	300.00	279.00	42.00	219.00	199.50	39.00
21	414.00	393.00[1]	36.00	330.00	303.00[1]	30.00	270.00	234.00[1]	51.00

[1] 50% hatch.

where age of the egg is expressed in hours. The value of R^2 is 0.96 for component 1 and 0.99 for component 2.

We compared our rates of egg development to other walleye pollock incubation studies in the 5–7°C range (Table 4). There was a significant difference between regression equations of incubation time to 50% hatch and temperature for western versus eastern North Pacific studies ($P<0.01$), but the slopes were not different ($P=0.18$). Based on the 95% confidence interval about the parameter estimates, time to 50% hatch of western North Pacific walleye pollock tended to be 1.2 to 1.3 times longer on average than that of the eastern North Pacific fish at a specific temperature.

Morphological descriptions

Walleye pollock eggs are pelagic and have a smooth, clear chorion and homogeneous yolk. No oil globules are present. Preserved eggs range from 1.2 to 1.8 mm in diameter, although most are 1.35–1.45 mm (Matarese et al., 1989). Appearance of the egg varies with type of preservative. There was little or no shrinkage of yolk material in Stockard's solution, whereas yolk of formalin-preserved eggs decreased in volume and the yolk membrane frequently collapsed. This effect of formalin preservation was helpful in determining how much of the tail had lifted away from the yolk in late-stage embryos.

Development of walleye pollock eggs and embryos, from fertilization to just before hatching, was divided into the following 21 stages (Table 2):

Precell (stage 1) Cytoplasm at the animal pole forms a blastodisc; bands of cytoplasm extend from below the equator to the blastodisc (Fig. 5A), which is without distinct margins (Fig. 6A). When intact, the yolk membrane almost touches the inner wall of the chorion. The perivitelline space is most visible over the blastodisc.

2 cells (stage 2) The first cell division of the blastodisc is in the horizontal plane. Cell material may not be equally divided (Figs. 5B and 6B).

4 cells (stage 3) The second cleavage is perpendicular to, and in the same plane as, the first. Cells are roughly equal in size and form a square (Figs. 5C and 6C).

8 cells (stage 4) The third cleavage is perpendicular to the second cleavage (parallel to first cleavage). Each cell divides in half in the horizontal

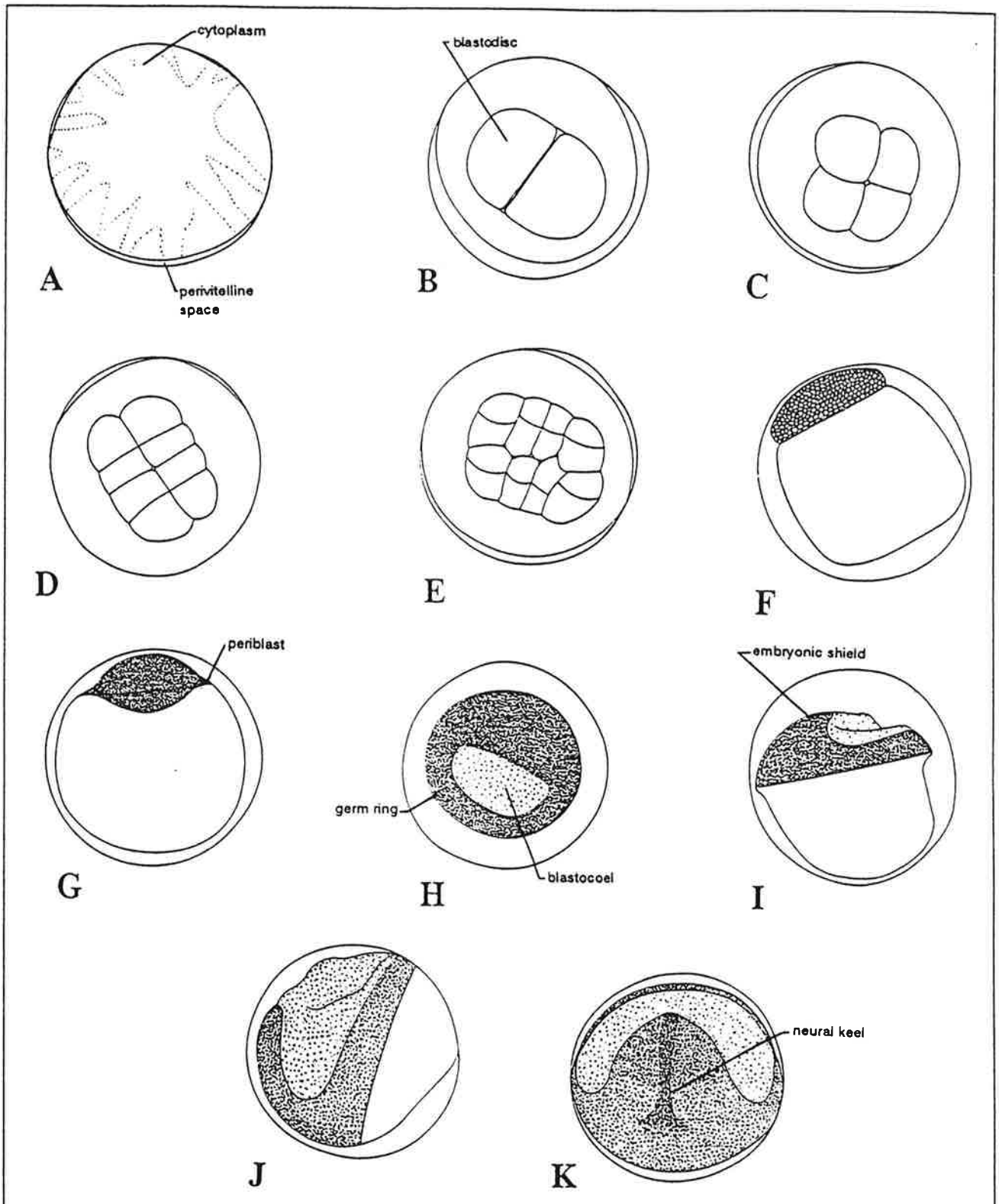


Figure 5

Illustrations of preserved *Theragra chalcogramma* eggs. (**A**) Stage 1 (precell); (**B**) Stage 2 (2 cell); (**C**) Stage 3 (4 cell); (**D**) Stage 4 (8 cell); (**E**) Stage 5 (16 cell); (**F**) Stage 6 (32 cell); (**G**) Stage 7 (blastodermal cap); (**H**) Stage 8 (early germ ring); (**I**) Stage 9 (germ ring 1/4, lateral view); (**J**) Stage 10 (germ ring 1/2, lateral view); (**K**) Stage 10 (dorsal view).

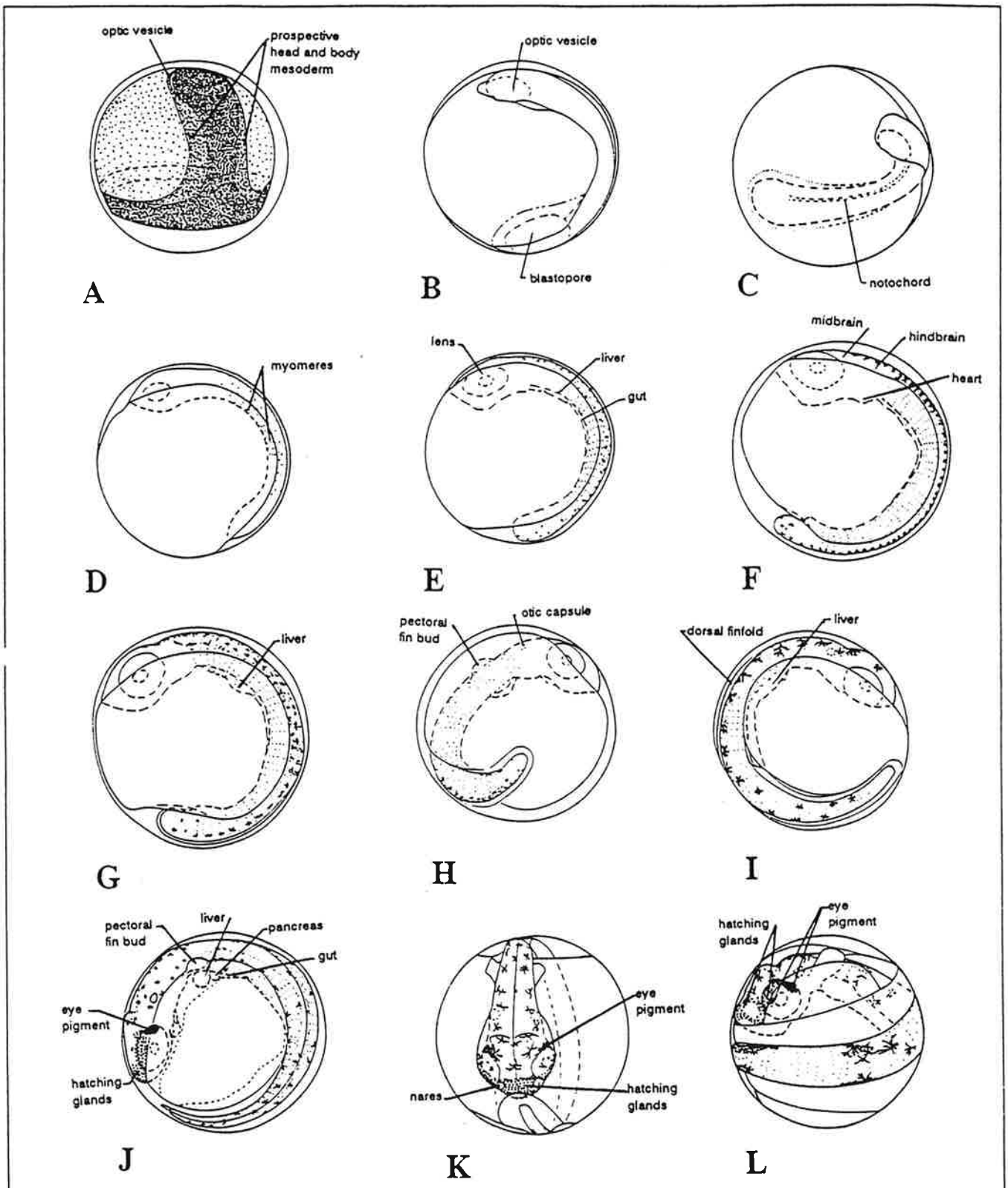


Figure 7

Illustrations of preserved *Theragra chalcogramma* eggs. (**A**) Stage 11 (germ ring 3/4); (**B**) Stage 12 (blastopore almost closed); (**C**) Stage 13 (early middle); (**D**) Stage 14 (middle middle); (**E**) Stage 15 (late middle); (**F**) Stage 16 (early late); (**G**) Stage 17 (tail 5/8 circle); (**H**) Stage 18 (tail 3/4 circle); (**I**) Stage 19 (tail 7/8 circle); (**J**) Stage 20 (tail full circle, lateral view); (**K**) Stage 20 (dorsal view); (**L**) Stage 21 (tail 1-1/8 circle).

Green Larval Notebook
- example page -

Station #	Date	Time (GMT)	CTD/XBT/SEACAT		0-[illegible] Sf/m	Otoliths 95% ETOH	[illegible]	M-sole [illegible] 40°	Rough Count	Comments
26 (E17)	5/5/94	2340	SEACAT						100/[illegible] x [illegible] = 0	10%
29 (D17)	5/6/94	0101	SEACAT			14			1000/[illegible] x 14 = 14	all sample [illegible]
30 (B17)	5/6/94	0211	SEACAT						100/[illegible] x 0 = 0	all sample [illegible]
31 (B19)	5/6/94	0333	SEACAT			8.			1000/1000 x 8 = 8	all sample [illegible]
32 (D19)	5/6/94	0436	SEACAT			11			1500/[illegible] x 11 = 110	10% sorted
33 (F19)	5/6/94	0551	SEACAT		9	9.			150/150 x 9 = 90	south sea [illegible]
33 Haul 2	5/6/94	0615	SEACAT		9	7	10	10 (1-10)		
33 Haul 3	5/6/94	0636	SEACAT							CalVET surface [illegible]
34 (H19)	5/6/94	0746	SEACAT			26			1000/1000 x 26 = 26	" "
35 (J19)	5/6/94	0904	"						100/[illegible] x 0 = 0	" "
36 (L19)	5/6/94	1014	"			.			1300/1300 x 0 = 0	" "
37 (L21)	5/6/94	1130	"			.			100/1000 x 0 = 0	" "
38 (J21)	5/6/94	1250	"			.			1000/[illegible] x 0 = 0	" "
39 (H21)	5/6/94	1409	"			63			1000/1000 x 63 = 63	" "
40 (F21)	5/6/94	1533	"		5	6			1000/1000 x 11 = 11	" "
41 (D21)	5/6/94	1717	"		9	11			1000/500 x 19 = 38	" "
42 (B21)	5/6/94	1836	.		10	9+17			2000/200 x 9 = 90	Inshore
42 Haul 2	5/6/94	1858					6	6 (11-16)		
42 (Haul 3)	5/6/94	1918					3	5 (17-21)		
42 (H.14)	5/6/94	1953								CalVET
43 (B23)	5/6/94	2036			10	6+25			100/[illegible] x 6 = 60	
44 (C23)	5/6/94	2151			10	5+10			1000/100 x 5 = 50	
45 (D23)	5/6/94	2322				11			[illegible] x 11 = 110	
46 (F23)	5/7/94	0047				11+25			1000/100 x 11 = 110	
47 (H23)	5/7/94	0159				13			1500 [illegible] x 13 = 65	20% [illegible]
48 (J23)	5/7/94	0318				10				all [illegible]
49 (J25)	5/7/94	0434								[illegible]

Green Notebook - Measurements Section

L-Musc

Muscle DNA #1-10 (No yolk sac)

Station #32 Ha. 12 12X/.0833mm/unit

South Sea Valley

#1 - 105 units = 8.75mm

#2 - 74 units = 6.16mm

#3 - 81 units = 6.75mm

#4 - 82 units = 6.83mm

#5 - 73 units = 6.08mm

#6 - 75 units = 6.25mm

7 73 units = 6.08mm

8 78 units = 6.49mm

9 71 units = 5.91mm

10 90 units = 7.49mm

Station #42 Ha. 12 (barely (i.e.) alive but within minutes of tow)

6X/.167mm/unit

Inshore

#11 - 42 units = 7.01mm

#12 - 39 units = 6.51mm

#13 - 36 units = 6.01mm

#14 - 39 units = 6.51mm

#15 - 38 units = 6.35mm

#16 - 43 units = 7.18mm

Station #42 Ha. 13

16X

#17 - 49 units = 8.18mm

#18 - 44 units = 7.35mm

#19 - 40 units = 6.68mm

#20 - 40 units = 6.68mm

#21 - 36 units = 6.01mm

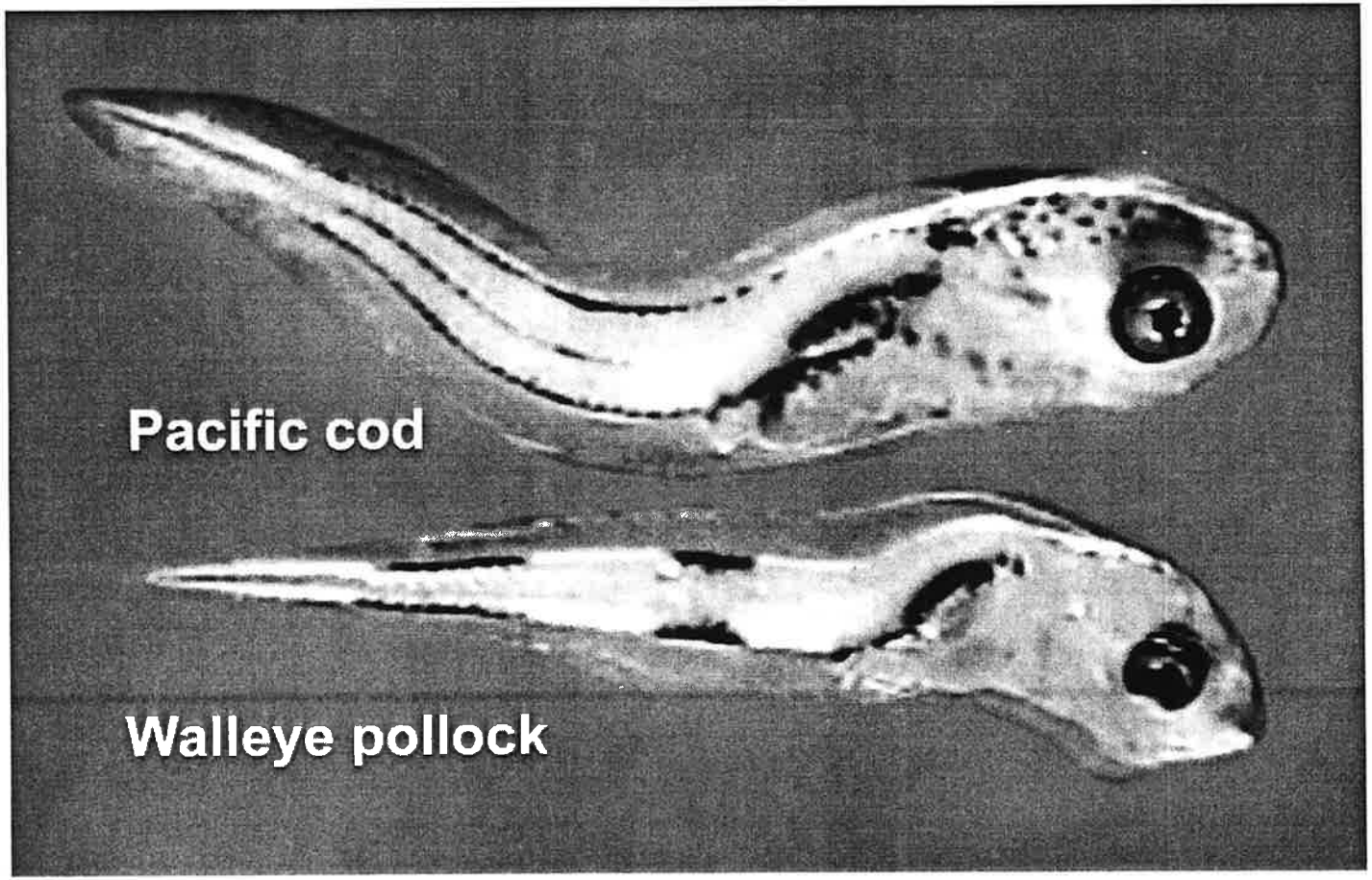
Larval Fish Identification

Larval fish identification is a time consuming process. It is often difficult to tell the difference between a cod and a pollock when there is a time restriction. The next seven pages included in this section are larval pictures and written descriptions of some of the fish larvae that may be encountered in the Gulf of Alaska and/or the Bering Sea. It is a good idea to study these pages when time permits so that you at least have some idea what to look for when you are sorting a plankton sample.

References:
Matarese, A. C., A. W. Kendall Jr., D. M. Blood, and B. M. Vinter. 1989. Laboratory Guide To Early Life History Stages of Northeast Pacific Fishes. U.S. Dep. Commer., NOAA Tech. Rep. NMFS 80, 652 p.

Info. provided by: A. Matarese

10-Mar-95


Pacific cod
Walleye pollock

The family Gadidae is represented in the Northeast Pacific Ocean and Bering Sea by five species: Walleye pollock, *Theragra chalcogramma*; Pacific cod, *Gadus macrocephalus*; Pacific tomcod, *Microgadus proximus*; saffron cod, *Eleginus gracilis*; and Arctic cod, *Boreogadus saida*. Identification of gadid larvae prior to 1980 was not possible. Gadid larvae collected during ichthyoplankton studies were routinely reported as "Gadidae." Recent taxonomic studies have continued since 1980 and have allowed the specific identification of all five species in the area (e.g., Matarese et al. 1981 and Dunn and Vinter 1984). Identification is based primarily on differences in pigmentation patterns and meristic characters. The available knowledge of the general early life histories of these five species was recently reviewed by Dunn and Matarese (1987).

Table 22

Characters useful in separating larvae of *Eleginus gracilis*, *Boreogadus saida*, *Gadus macrocephalus*, *Theragra chalcogramma*, and *Microgadus proximus* at specific size ranges (Dunn and Vinter 1984, in part).

Character	Size range (mm SL)	*E. gracilis*	*B. saida*	*G. macrocephalus*	*T. chalcogramma*	*M. proximus*
Pigment						
Preanal region						
Ventral gut	4.4-13.5	Double row of small melanophores	Absent in larvae <10mm; spots present anterior to pectoral fins in larvae >10 mm	Large melanophores medially	Relatively few scattered spots, more anterior than posterior	Large melanophores present, more anterior than posterior
Line of lateral pigment	10-18	Begins anterior to anus	Begins under second dorsal fin	Begins anterior to anus	Begins under second dorsal fin	Begins just anterior to anus
Postanal region						
Length of ventral stripes (based on no. of melanophores)	4-6	Both longer than dorsal stripes	Both shorter than dorsal stripes	Anterior stripe longer than dorsal stripe (<5.3 mm)	Posterior stripe longer than dorsal stripe	Anterior stripe longer than dorsal stripe (<5 mm)
No. of myomeres from vertical end of anus to anterior end of first ventral pigment stripe	4-6	4-6	5-7	1-3 (reaches vent by ~5.3 mm)	4-5	1-3 (reaches vent by ~5.0 mm)
Length at which dorsal pigment forms a continuous line	4-15	~10 mm	~7 mm	~5-6 mm	~13 mm	~13 mm
Length at which ventral pigment forms a continuous line	4-10	~7 mm	~10 mm	~5-6 mm	Never merge	~5-6 mm
On ventral margin of body	10-15	In double row on each side of midline	Pigment on midline and scattered on each side	Single row on each side of midline	Pigment on midline and a single row on each side	Single row on each side of midline anteriorly, single row on midline posteriorly
Morphologic						
Position of vent relative to dorsal fins	15-20	Under second dorsal	Under second dorsal	Under second dorsal	Between first and second dorsal	Between first and and second dorsal (ultimately under first dorsal)
Meristic						
No. of rays on superior hypural	>13	5	4	4	4	5

MERISTICS

Vertebrae	Total: 53-X-58
	Precaudal: 18-X-20
	Caudal: 35-X-39
Branchiostegal rays	7-7-7
Caudal fin	21-25, 4+2, 21-25
Pelvic fin	Thoracic
	R: 6-6-6
Dorsal fin	1st: 10-X-17 2nd: 11-X-18
	3rd: 16-X-24
Pectoral fin	R: 18-X-19
Anal fin	1st: 13-X-21 2nd: 17-X-23
Gill rakers	U: 8-X-9 L: 29-X-34

LIFE HISTORY

Range	Bering Sea, 54-66°N, to Arctic, not specific
Ecology	Epi- and mesopelagic, 0-731 m
ELH pattern	Oviparous, pelagic eggs, pelagic larvae
Spawning	Season: Oct-Mar[a]
	Area: Nearshore[b]
	Mode: Schools[b]
	Migration: Nearshore to spawn[b]
Fecundity	Range/function: 9000-21,000[a]
Age at first maturity	3 yr (females)[b]
	2-3 yr (males)[b]
Longevity	7 yr[b]

EARLY LIFE HISTORY DESCRIPTION

EGGS

Diameter	1.53-1.90 mm
No. of oil globules	None
Oil globule diameter	
Yolk	Homogeneous
Envelope	Smooth
Hatch size	6 mm SL
Incubation time/temp.	
Pigment	

Diagnostic characters

LARVAE

Preanal length	<50% SL
Length at flexion	11-17 mm SL
Length at transformation	17-30 mm, pelagic until 30-45 mm SL
Sequence of fin development	Caudal, dorsals and anals, pectorals, pelvics

Pigment

- Presence of bars
- Shorter ventral stripes
- Mediolateral pigment

Diagnostic characters (see Table 22)

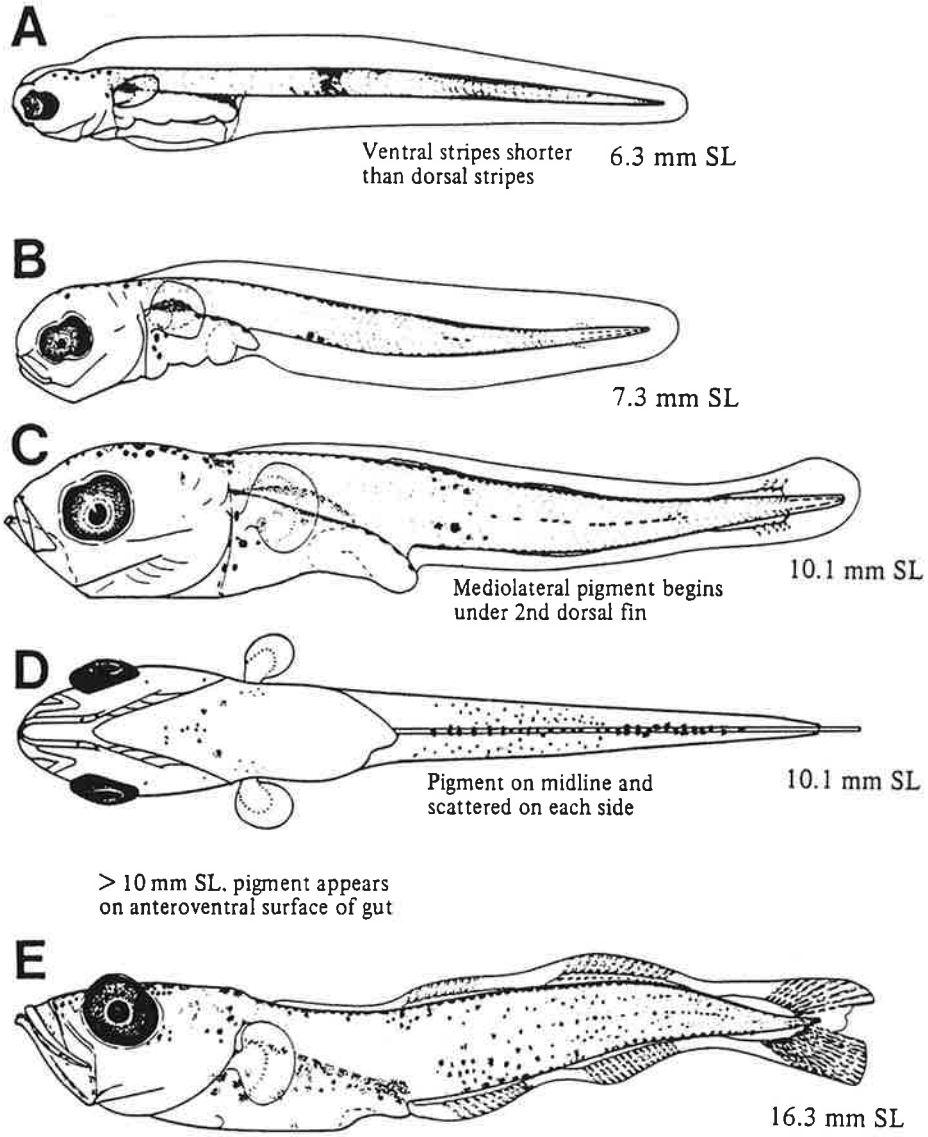
- Ventral pigment on midline and scattered on each side
- Rays on superior hypural = 4

Distinguished from *Theragra chalcogramma* by

- Ventral pigment on midline and scattered on each side. In *T. chalcogramma*, ventral pigment consists of a row along midline and a single row on each side.

[a] Bain and Sekerak 1978
[b] Craig et al. 1982

Ref: Dunn and Matarese 1984, Dunn and Vinter 1984.



Figures A–D (D, ventral view), Dunn and Vinter 1984; E, NWAFC original (B. Vinter).

MERISTICS

Vertebrae	Total: 57-62-64
	Precaudal: 21-X-24
	Caudal: 37-X-41
Branchiostegal rays	7-7-7
Caudal fin	22-25, 5+2, 23-26
Pelvic fin	Thoracic
	R: 6-6-6
Dorsal fin	1st: 11-X-16 2nd: 15-X-23
	3rd: 18-X-21
Pectoral fin	R: 18-X-21
Anal fin	1st: 20-X-24 2nd: 19-X-22
Gill rakers	U: 2-X-3 L: 17-X-20

LIFE HISTORY

Range	Gulf of Alaska, 54-60°N, to Arctic, not specific
Ecology	Nearshore shelf pelagic, 2-75 m
ELH pattern	Oviparous, demersal eggs, pelagic larvae
Spawning	Season: Winter[a]
	Area: Shallow nearshore (2-10 m)[a]
	Mode:
	Migration: To shallow water for spawning[a]
Fecundity	Range/function: 28,900-190,700[a]
Age at first maturity	2 yr[a]
Longevity	9 yr[a]

EARLY LIFE HISTORY DESCRIPTION

EGGS

Diameter	1.0-1.7 mm (1.3-1.7 mm)
No. of oil globules	None
Oil globule diameter	
Yolk	Homogeneous, dense
Envelope	Smooth, thick
Hatch size	3.5 mm SL
Incubation time/temp.	
Pigment	

Diagnostic characters

LARVAE

Preanal length	<50% SL
Length at flexion	11-17 mm SL
Length at transformation	24-27 mm SL
Sequence of fin development	Caudal, dorsals and anals (nearly simultaneous), pelvics, pectorals

Pigment

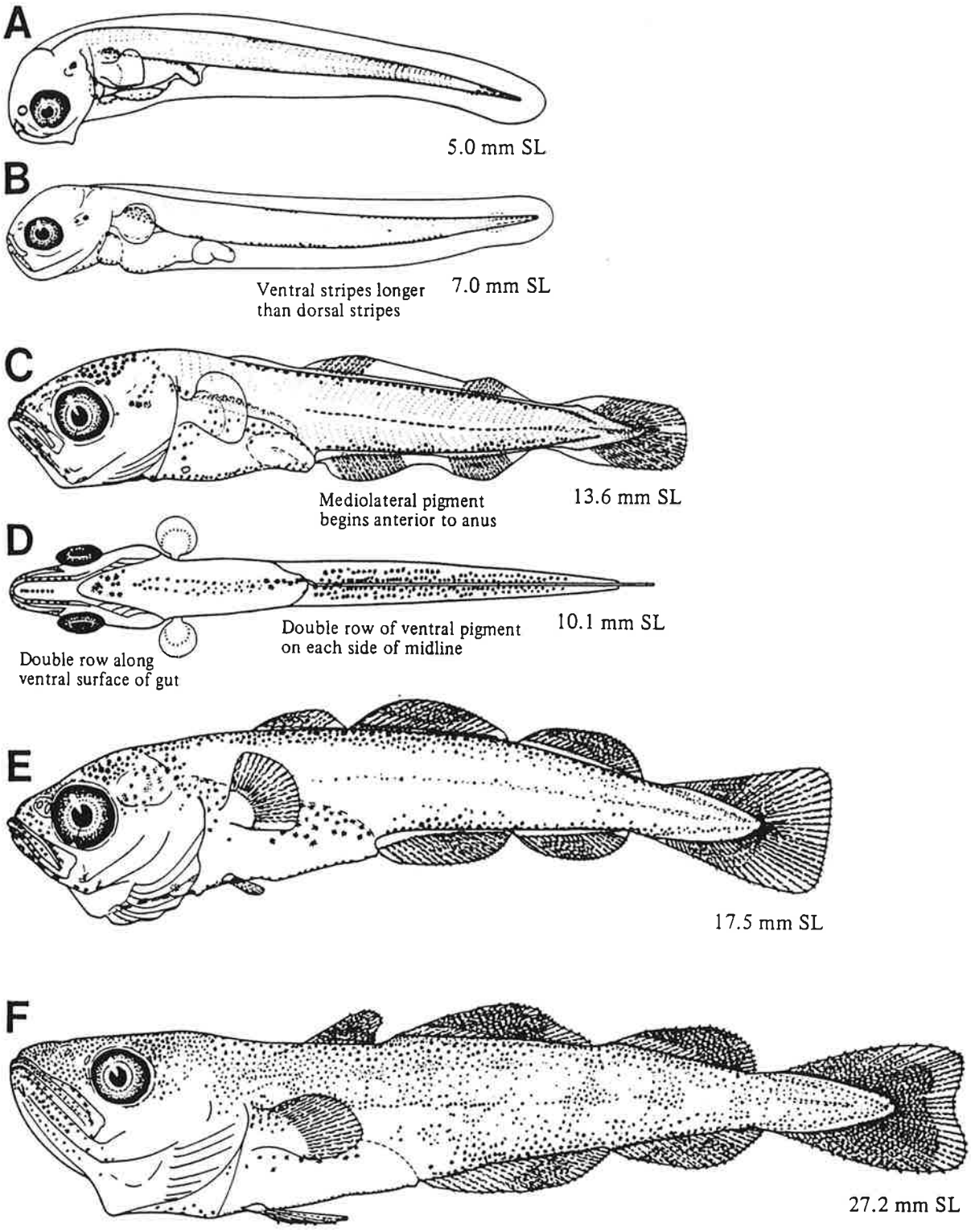
- Presence of bars
- Ventral stripes longer than dorsal stripes
- Ventral pigment in double row on each side of midline
- Mediolateral pigment begins anterior to anus
- Double row of melanophores along ventral surface of gut

Diagnostic characters (see Table 22)

- Pigment
  - —Double row of melanophores along ventral surface of gut
  - —Double row of ventral pigment on each side of midline
- Rays on superior hypural = 5

[a] Wolotira 1985

Ref: Dunn and Matarese 1984, Dunn and Vinter 1984.



Figures A–F (D, ventral view), Dunn and Vinter 1984.

MERISTICS

Vertebrae	Total: 49-54-56 Precaudal: 18-X-21 Caudal: 31-X-35
Branchiostegal rays	7-7-7
Caudal fin	23-24, 4+2, 21-22
Pelvic fin	Thoracic R: 6-X-7
Dorsal fin	1st: 10-12-16 2nd: 11-15-22 3rd: 10-X-21
Pectoral fin	R: 19-20-22
Anal fin	1st: 16-18-27 2nd: 12-17-25
Gill rakers	U: X-X-X L:X-X-X

LIFE HISTORY

Range	S. California, 32-34°N, to Bering Sea, 54-66°N
Ecology	Epi-, meso-, and bathybenthal
ELH pattern	Oviparous, demersal eggs, pelagic larvae (small larvae demersal)[a]
Spawning	Season: Jan[b]-July[c] Area: Semi-demersal (73-265 m)[c] Mode: Schools[b] Migration: To deepwater[d]
Fecundity	Range/function: 228,000[e]-3 million[f]/ $F = 12.024 \times L^{2.959}$ [g]
Age at first maturity	2 yr[d]
Longevity	13 yr[f]

[a] Walters (1984) reported small larvae are demersal whereas Rugen and Matarese (1988) reported newly hatched larvae quickly rise to above 50 m.
[b] Miller et al. 1978
[c] Hirschberger and Smith 1983
[d] Ketchen 1961
[e] Thompson 1962
[f] Andriashev 1954
[g] Karp 1982

Ref: Dunn and Matarese 1984, 1987; Dunn and Vinter 1984; Matarese et al. 1981; Walters 1984.

EARLY LIFE HISTORY DESCRIPTION

EGGS

Diameter	0.98-1.08 mm (1.02 mm)
No. of oil globules	None
Oil globule diameter	
Yolk	Homogeneous, dense
Envelope	Smooth, thick
Hatch size	3-4 mm SL
Incubation time/temp.	
Pigment	

Diagnostic characters

LARVAE

Preanal length	<50% SL
Length at flexion	10-17 mm SL
Length at transformation	25-35 mm SL
Sequence of fin development	

Pigment

- Presence of bars
- Ventral gut with large melanophores (in larvae >20 mm SL, small spots occur in two rows along ventral surface of gut)
- Stripe continuity (~5-6 mm SL)
- Mediolateral pigment begins anterior to anus (~5-6 mm SL)

Diagnostic characters (see Table 22)

- Pigment
  - —Large melanophores medially along length of gut
  - —Single irregular row of pigment on each side of ventral midline
  - —Ventral pigment begins at anus after yolksac absorption
- Rays on superior hypural = 4

Distinguished from *Theragra chalcogramma* at yolksac stage by

- Less lateral pigment within bars
- Posterior bar longer, extending closer to tail
- Presence of about 2-6 spots in the ventral caudal region
- More pigment in snout area and on mouth

Distinguished from *T. chalcogramma* at later stages by

- Generally more pigmented, especially on head and gut

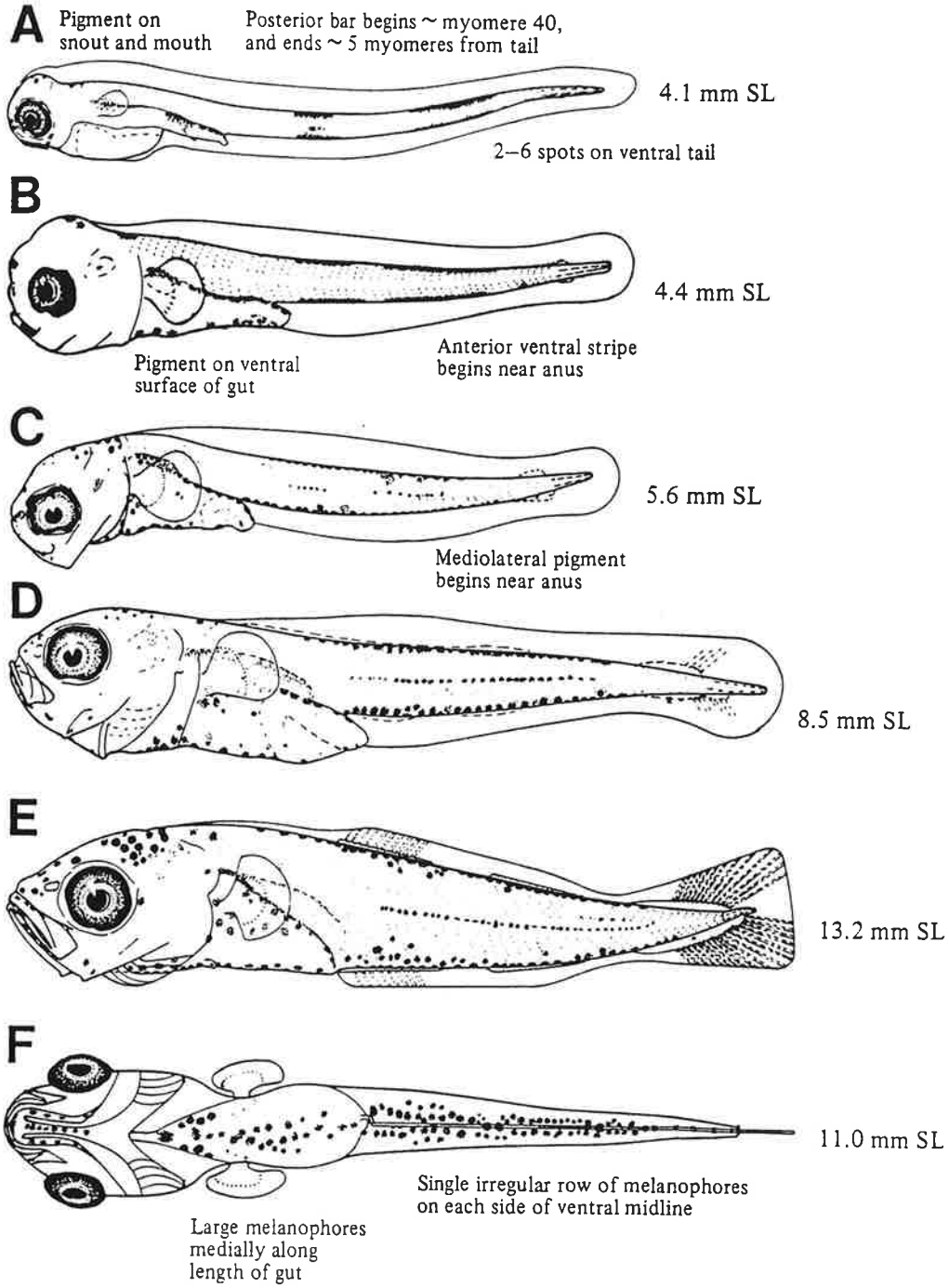


Figure A, NWAFC original (B. Vinter); B, E–F (F, ventral view), Dunn and Vinter 1984; C–D, Matarese et al. 1981.

MERISTICS

Vertebrae	Total: 53-56-60	
	Precaudal: 17-20-21	
	Caudal: 33-37-40	
Branchiostegal rays	6-X-8	
Caudal fin	22-26, 5+2, 20-24	
Pelvic fin	Thoracic	
	R: 6-X-7	
Dorsal fin	1st: 9-X-15	2nd: 16-X-21
	3rd: 17-X-24	
Pectoral fin	R: 19-19-19	
Anal fin	1st: 20-X-29	2nd: 18-X-28
Gill rakers	U: 3-X-5	L: 18-X-23

LIFE HISTORY

Range	Cent. California, 34-38°N, to Bering Sea, 54-66°N[a]
Ecology	Epi- and mesobenthal, 0-275 m
ELH pattern	Oviparous, demersal eggs, pelagic larvae
Spawning	Season: Winter-spring[b]
	Area:
	Mode:
	Migration:
Fecundity	Range/function:
Age at first maturity	
Longevity	

EARLY LIFE HISTORY DESCRIPTION

EGGS

Diameter	
No. of oil globules	Probably none
Oil globule diameter	
Yolk	Homogeneous
Envelope	
Hatch size	3 mm SL
Incubation time/temp.	
Pigment	

Diagnostic characters

LARVAE

Preanal length	<50% SL
Length at flexion	8-15 mm SL
Length at transformation	22-28 mm, pelagic from 28-45 mm SL
Sequence of fin development	Caudal; 1st anal; 2nd anal; 3rd, 2nd, and 1st dorsal (nearly simultaneously); pelvics; pectorals

Pigment

- Presence of bars
- Single row on each side of ventral midline anteriorly and a single row along ventral midline posteriorly
- Large melanophores scattered on ventral surface of gut

Diagnostic characters (see Table 22)

- Pigment
  - —Single row on each side of ventral midline anteriorly and a single row along ventral midline posteriorly
  - —Large melanophores scattered on ventral surface of gut
- Anterior placement of bars
- Rays on superior hypural = 5

Distinguished from *Gadus macrocephalus* by

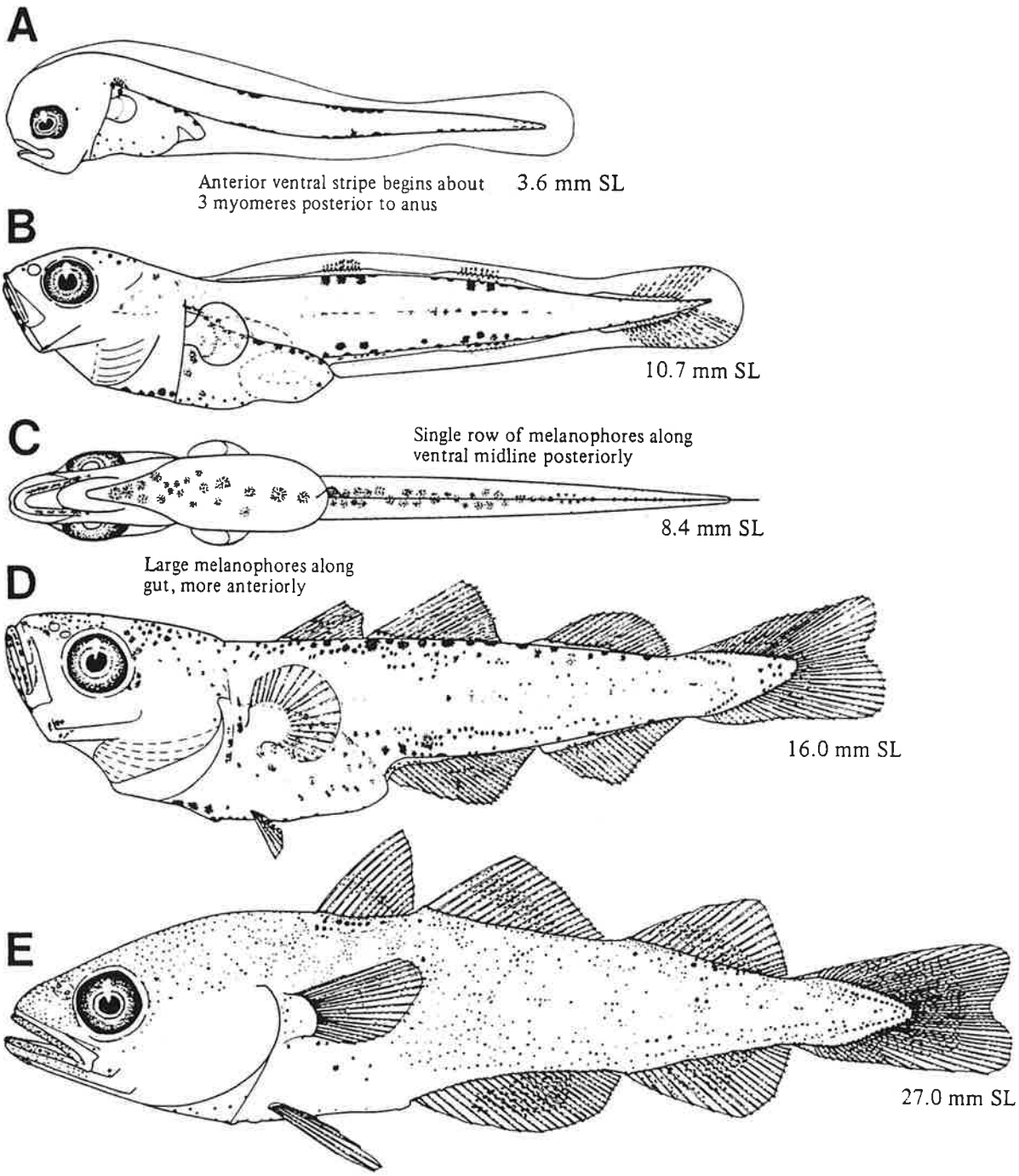
- Dorsal pigment separated in specimens <13 mm SL, bars not continuous

Distinguished from *Theragra chalcogramma* by

- Anterior bar begins closer to anus

[a] The presence of *M. proximus* larvae in the Bering Sea remains a question.
[b] Richardson 1977

Ref: Dunn and Vinter 1984, Matarese et al. 1981.



Figures A–E (C, ventral view), Matarese et al. 1981.

MERISTICS

Vertebrae	Total: 48-51-53	
	Precaudal: 18-X-20	
	Caudal: 31-X-34	
Branchiostegal rays	6-X-8	
Caudal fin	21-24, 4+2, 19-22	
Pelvic fin	Thoracic	
	R: 6-X-7	
Dorsal fin	1st: 10-12-14	2nd: 12-14-18
	3rd: 14-17-21	
Pectoral fin	R: 17-20-22	
Anal fin	1st: 15-18-22	2nd: 15-18-23
Gill rakers[a]	U: 5-X-7	L: 25-X-34

LIFE HISTORY

Range	Cent. California, 34-38°N, to Chukchi Sea, north of 66°N
Ecology	Epi-, meso-, and bathypelagic, 0-975 m
ELH pattern	Oviparous, pelagic eggs, pelagic larvae
Spawning	Season: Feb-Aug[a] Area: Pelagic (50-460 m)[a] Mode: Schools[b] Migration: Bering Sea, offshore to outer and upper slope;[c] Gulf of Alaska to Shelikof Strait[d]
Fecundity	Range/function: 91,633-1,200,000/ $F=0.1719\times L^{3.6046}$, L=FL cm;[e] 96,216-1,079,540/ $F=1.2604\times L^{3.2169}$, L=FL cm[f]
Age at maturity	3-4 yr[g]
Longevity	17 yr[g]

EARLY LIFE HISTORY DESCRIPTION

EGGS

Diameter	1.35-1.45 mm (1.2-1.8)
No. of oil globules	None
Oil globule diameter	
Yolk	Homogeneous
Envelope	Smooth, clear
Hatch size	3-4 mm SL
Incubation time/temp.	15 d/5°C

Pigment
- Late-stage embryo develops bar pattern

Diagnostic characters
- Late-stage embryo with pigment

LARVAE

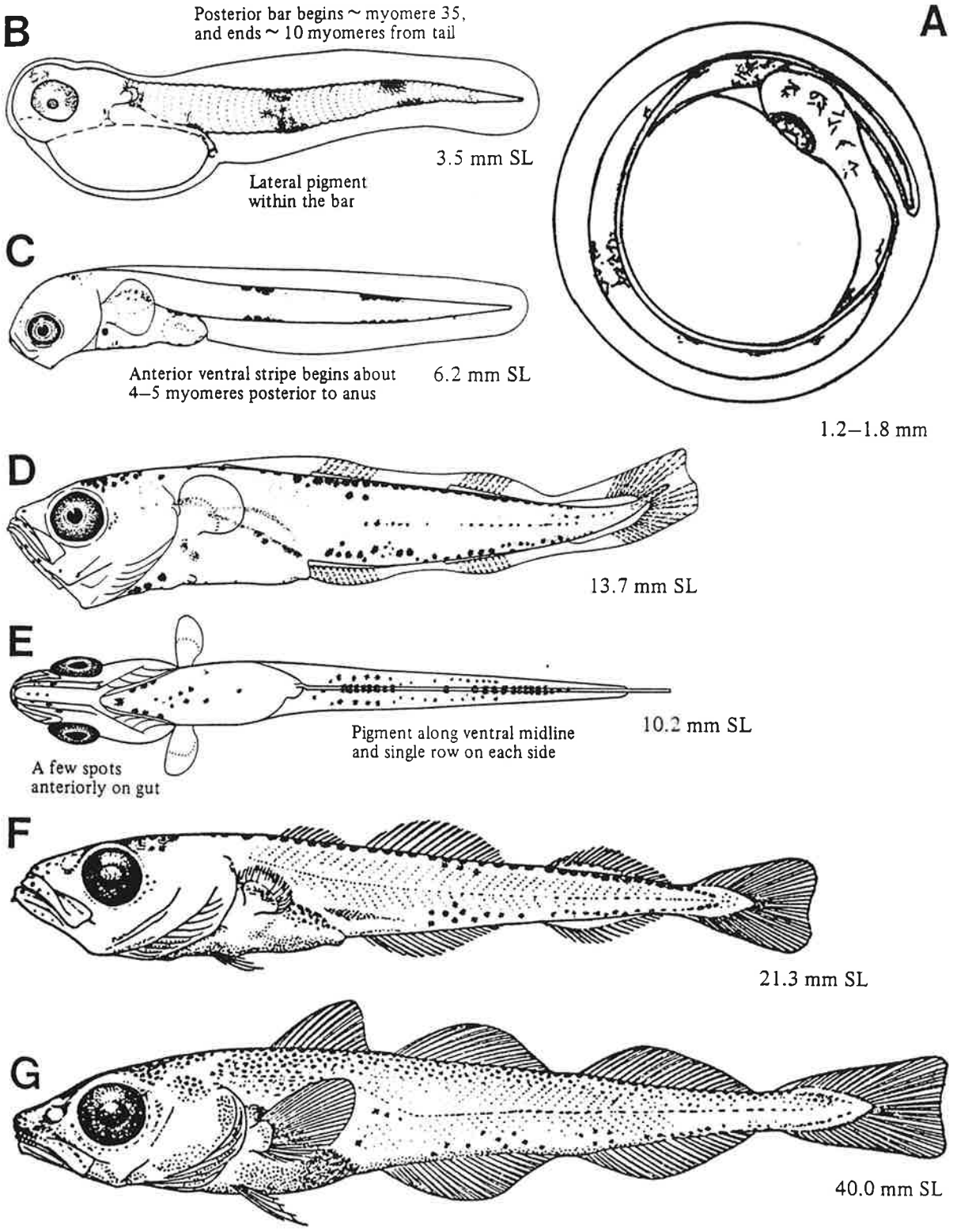
Preanal length	<50% SL
Length at flexion	10-17 mm SL
Length at transformation	30-40 mm SL
Sequence of fin development	Caudal, 1st anal, 2nd anal, 3rd dorsal, 2nd dorsal, 1st dorsal, pelvics, pectorals

Pigment
- Presence of bars
- A few melanophores scattered on ventral surface of gut
- Pigment along ventral midline and a single row on each side

Diagnostic characters (see Table 22)
- See *Gadus macrocephalus* (p. 194)
- Pigment
  - —A few melanophores scattered on ventral surface of gut
  - —Pigment along ventral midline and a single row on each side
- Rays on superior hypural = 4

[a] Hirschberger and Smith 1983
[b] Takahura 1954
[c] Serobaba 1968
[d] Dunn and Matarese 1987
[e] Hinckley 1986 (Bering Sea specimens only)
[f] Miller et al. 1986 (Shelikof Strait specimens only)
[g] Salveson and Alton 1976a

Ref: Dunn and Matarese 1984, 1987; Dunn and Vinter 1984.



Figures A–B, NWAFC originals (B. Vinter); C–E (E, ventral view), Dunn and Vinter 1984; F–G, Gorbunova 1954.

KEY TO THE FIELD IDENTIFICATION OF LIVE JUVENILE GADIDS IN THE SOUTHERN BERING SEA

1A. Lower jaw length equal to upper (terminal mouth position) or distinctly projecting (superior mouth position) 2

1B. Lower jaw length less than upper (inferior mouth position) 3

2A. Barbel absent or minute (<3.0% SL), snout with abrupt, somewhat square tip, tail lunate, with a nearly straight edge. .....***Theragra chalcogramma***

2B. Barbel small (≈4.0% HL) and thin, less than length of pupil, snout blunt with rounded tip, tail deeply forked. .....***Boreogadus saida***

3A. Anus located between first and second dorsal fin, body depth < 20% HL.....4

3B. Anus location other than between first and second dorsal, fin, body depth > 20% SL.....5

4A. Barbel of medium length, nearly equal to length of pupil (≈8.0% HL).....***Eleginus gracilis***

4B. Barbel large, length equal or greater than pupil (>10.0% HL) 5

5A. Anus located below or slightly behind origin of second dorsal fin, barbel very large, greater than length of pupil (≈19% HL) .....***Gadus macrocephalus***

5B. Anus located under posterior portion of first dorsal fin, barbel large, equal to length of pupil (≈10.5% HL) .....***Microgadus proximus***

Additional Taxonomic Notes

1. Barbels of *Boreogadus, Eleginus, Microgadus* are unpigmented or lightly pigmented. Barbels of *Theragra* (when present) and *Gadus* are heavily pigmented, especially at the base.

2. *Theragra* and *Boreogadus* have darkly pigmented peritoneal cavities.

Info. provided by: M. Busby

2-Feb-99

3. Live coloration:

Theragra - Gold to a light pink or bronze hue.

Boreogadus - Brown or silver with fine black dots (according to Baxter 1989).

Eleginus - Brown or dark olive with silver or violet dorsally. Edges of caudal and dorsal fins with white band (Baxter 1989).

Microgadus - Dusky gray to greenish with dusky fins.

Gadus - Dusky gray to silver or brown with yellow spots or mottling.

References:
Rae Baxter, 1989. Annotated Key To The Fishes of Alaska. Unpubl.

MEASUREMENT

TABLE I. MEASUREMENT UNITS

Length

U.S. Customary Unit	U.S. Equivalents	Metric Equivalents
inch	0.083 foot	2.540 centimeters
foot	⅓ yard, 12 inches	0.305 meter
yard	3 feet, 36 inches	0.914 meter
rod	5½ yards, 16½ feet	5.029 meters
mile (statute, land)	1,760 yards, 5,280 feet	1.609 kilometers
mile (nautical, international)	1.151 statute miles	1.852 kilometers

Area

U.S. Customary Unit	U.S. Equivalents	Metric Equivalents
square inch	0.007 square foot	6.452 square centimeters
square foot	144 square inches	929.030 square centimeters
square yard	1,296 square inches, 9 square feet	0.836 square meters
acre	43,560 square feet, 4,840 square yards	4.047 square meters
square mile	640 acres	2.590 square kilometers

Weight

U.S. Customary Unit (Avoirdupois)	U.S. Equivalents	Metric Equivalents
grain	0.036 dram, 0.002285 ounce	64.798 milligrams
dram	27.344 grains, 0.0625 ounce	1.772 grams
ounce	16 drams, 437.5 grains	28.350 grams
pound	16 ounces, 7,000 grains	453.592 grams
ton (short)	2,000 pounds	0.907 metric ton (1,000 kilograms)
ton (long)	1.12 short tons, 2,240 pounds	1.016 metric tons

Apothecary Weight Unit	U.S. Customary Equivalents	Metric Equivalents
scruple	20 grains	1.296 grams
dram	60 grains	3.888 grams
ounce	480 grains, 1.097 avoirdupois ounces	31.103 grams
pound	5,760 grains, 0.823 avoirdupois pound	373.242 grams

Volume or Capacity

U.S. Customary Unit	U.S. Equivalents	Metric Equivalents
cubic inch	0.00058 cubic foot	16.387 cubic centimeters
cubic foot	1,728 cubic inches	0.028 cubic meter
cubic yard	27 cubic feet	0.765 cubic meter

U.S. Customary Liquid Measure	U.S. Equivalents	Metric Equivalents
fluid ounce	8 fluid drams, 1.804 cubic inches	29.573 milliliters
pint	16 fluid ounces, 28.875 cubic inches	0.473 liter
quart	2 pints, 57.75 cubic inches	0.946 liter
gallon	4 quarts, 231 cubic inches	3.785 liters
barrel	varies from 31 to 42 gallons, established by law or usage	

U.S. Customary Dry Measure	U.S. Equivalents	Metric Equivalents
pint	½ quart, 33.6 cubic inches	0.551 liter
quart	2 pints, 67.2 cubic inches	1.101 liters
peck	8 quarts, 537.605 cubic inches	8.810 liters
bushel	4 pecks, 2,150.420 cubic inches	35.239 liters

British Imperial Liquid and Dry Measure	U.S. Customary Equivalents	Metric Equivalents
fluid ounce	0.961 U.S. fluid ounce, 1.734 cubic inches	28.413 milliliters
pint	1.032 U.S. dry pints, 1.201 U.S. liquid pints, 34.678 cubic inches	568.245 milliliters
quart	1.032 U.S. dry quarts, 1.201 U.S. liquid quarts, 69.354 cubic inches	1.136 liters
gallon	1.201 U.S. gallons, 277.420 cubic inches	4.546 liters
peck	554.84 cubic inches	0.009 cubic meter
bushel	1.032 U.S. bushels, 2,219.36 cubic inches	0.036 cubic meter

THE METRIC SYSTEM

Length

Unit	Number of Meters	Approximate U.S. Equivalent	Unit	Number of Meters	Approximate U.S. Equivalent
myriameter	10,000	6.214 miles	meter	1	39.370 inches
kilometer	1,000	0.621 mile	decimeter	0.1	3.937 inches
hectometer	100	109.361 yards	centimeter	0.01	0.394 inch
decameter	10	32.808 feet	millimeter	0.001	0.039 inch

Area

Unit	Number of Square Meters	Approximate U.S. Equivalent	Unit	Number of Square Meters	Approximate U.S. Equivalent
square kilometer	1,000,000	0.386 square mile	deciare	10	11.960 square yards
hectare	10,000	2.477 acres	centare	1	10.764 square feet
are	100	119.599 square yards	square centimeter	0.0001	0.115 square inch

MEASUREMENT *(continued)*

Volume

Unit	Number of Cubic Meters	Approximate U.S. Equivalent	Unit	Number of Cubic Meters	Approximate U.S. Equivalent
decastere	10	13.079 cubic yards	decistere	0.10	3.532 cubic feet
stere	1	1.308 cubic yards	cubic centimeter	0.000001	0.061 cubic inch

Capacity

Unit	Number of Liters	Approximate U.S. Equivalents Cubic	Dry	Liquid
kiloliter	1,000	1.308 cubic yards		
hectoliter	100	3.532 cubic feet	2.838 bushels	
decaliter	10	0.353 cubic foot	1.135 pecks	2.642 gallons
liter	1	61.024 cubic inches	0.908 quart	1.057 quarts
deciliter	0.10	6.102 cubic inches	0.182 pint	0.211 pint
centiliter	0.01	0.610 cubic inch		0.338 fluid ounce
milliliter	0.001	0.061 cubic inch		0.271 fluid dram

Mass and Weight

Unit	Number of Grams	Approximate U.S. Equivalent	Unit	Number of Grams	Approximate U.S. Equivalent
metric ton	1,000,000	1.102 tons	gram	1	0.035 ounce
quintal	100,000	220.462 pounds	decigram	0.10	1.543 grains
kilogram	1,000	2.205 pounds	centigram	0.01	0.154 grain
hectogram	100	3.527 ounces	milligram	0.001	0.015 grain
decagram	10	0.353 ounce			

METRIC CONVERSION CHART—APPROXIMATIONS

When You Know	Multiply By	To Find
	Length	
millimeters	0.04	inches
centimeters	0.39	inches
meters	3.28	feet
meters	1.09	yards
kilometers	0.62	miles
inches	25.40	millimeters
inches	2.54	centimeters
feet	30.48	centimeters
yards	0.91	meters
miles	1.61	kilometers
	Area	
square centimeters	0.16	square inches
square meters	1.20	square yards
square kilometers	0.39	square miles
hectares (10,000m^2)	2.47	acres
square inches	6.45	square centimeters
square feet	0.09	square meters
square yards	0.84	square meters
square miles	2.60	square kilometers
acres	0.40	hectares
	Mass and Weight	
grams	0.035	ounce
kilograms	2.21	pounds
tons (100kg)	1.10	short tons
ounces	28.35	grams
pounds	0.45	kilograms
short tons (2000 lb)	0.91	tons
	Volume	
milliliters	0.20	teaspoons
milliliters	0.06	tablespoons
milliliters	0.03	fluid ounces
liters	4.23	cups
liters	2.12	pints

When You Know	Multiply By	To Find
	Volume	
liters	1.06	quarts
liters	0.26	gallons
cubic meters	35.32	cubic feet
cubic meters	1.35	cubic yards
teaspoons	4.93	milliliters
tablespoons	14.78	milliliters
fluid ounces	29.57	milliliters
cups	0.24	liters
pints	0.47	liters
quarts	0.95	liters
gallons	3.79	liters
	Volume	
cubic feet	0.03	cubic meters
cubic yards	0.76	cubic meters
	Speed	
miles per hour	1.61	kilometers per hour
kilometers per hour	0.62	miles per hour
	Temperature (exact)	
Celsius temp.	9/5, +32	Fahrenheit temp.
Fahrenheit temp.	−32, 5/9 × remainder	Celsius temp.

Temperatures in degrees Celsius, as in the familiar Fahrenheit system, can only be learned through experience. The following temperatures are ones that are frequently encountered:

0°C	Freezing point of water (32°F)
10°C	A warm winter day (50°F)
20°C	A mild spring day (68°F)
30°C	A hot summer day (86°F)
37°C	Normal body temperature (98.6°F)
40°C	Heat wave conditions (104°F)
100°C	Boiling point of water (212°F)

On-Deck Sampling Info.

Gear Type	Survey	Sample Type	Gear Depth	Wire Out Rate	Wire In Rate	Wire Angle	Ship Speed
60 cm bongo	grid - egg	QTowF (505 um)	10 m off bottom	40 m/min	20 m/min	45	1.5 -2.0 knots
60 cm bongo	grid - larvae	QTowF (333 um)	10 m off bottom	40 m/min	20 m/min	45	1.5 - 2.0 knots
60 cm bongo	grid - larvae	QTowF (505 um)	100 m	40 m/min	20 m/min	45	1.5 - 2.0 knots
60 cm bongo	special	Live larvae	50 - 70 m	45 m/min	10 m/min	0	maintain wire angle
20/60 cm bongo	Fox (Line 8, 16, etc.)	QTowF	10 m off bottom	40 m/min	20 m/min	45	1.5 - 2.0 knots
calvet	special	QTowF (53 um)	60 m	40 - 50 m/min	40 - 50 m/min	0	maintain wire angle
methot	special	QTowF/Special	by request	40 m/min	20 m/min		2 - 3 knots
ring 0.8	special	Live mz	by request	40 - 50 m/min	10 m/min	0	maintain wire angle
sled	special	QTowF	by request	40 m/min	see manual	see manual	see manual
tucker 1M	special	QTowF/Special	by request	50 m/min	20 m/min	45	1.5 - 2.0 knots

Use of -80°C Freezer

All samples to be stored in the -80°C freezer must be in either white freezer boxes or packaged such that small samples will not be found lying loose on the bottom of the freezer. Secure each box closed with rubber bands.

Please label boxes or other containers with the following:

- sample type
- year/cruise/station number(s)
- owner's name/office phone number

All properly packaged samples put into the -80°C freezer will be off-loaded and stored in the -80°C freezer at NOAA/AFSC/Bldg 4/Room #2095.

Any loose samples found at the bottom of the -80°C freezer aboard the RV Miller Freeman will stay there and wait for the owner to claim them. Often, the freezers aboard ship are shut down when not in use, so all samples left too long will be lost.

In an emergency (loss of main generator power), it is possible to have the freezer hooked up to the emergency power generator. If this situation arises, the Chief Scientist or Watch Chief should discuss the situation with the ship's F.O.O.(Field Operations Officer). The freezer will be alright without power until the temperature reaches -50°C. If for some reason the -80°C freezer goes down due to mechanical difficulty, then the last resort taken to save the samples should be to transfer them to one of the other freezers on the ship (blast freezer or food freezer). The samples should then be packaged in an insulated box of some sort (a cooler is best if available) and moved quickly. Make sure that a sign is posted on the -80°C freezer telling the new location of the samples.

Please do not store any chemicals in the freezer.

Amount of wire needed to reach a specified net depth with a wire angle of 45 degrees. All depths are in meters.

Desired Net Depth	Wire Out	*Desired Net Depth*	Wire Out	*Desired Net Depth*	Wire Out	*Desired Net Depth*	Wire Out
5	7	***155***	219	***305***	431	***455***	643
10	14	***160***	226	***310***	438	***460***	651
15	21	***165***	233	***315***	445	***465***	658
20	28	***170***	240	***320***	453	***470***	665
25	35	***175***	247	***325***	460	***475***	672
30	42	***180***	255	***330***	467	***480***	679
35	49	***185***	262	***335***	474	***485***	686
40	57	***190***	269	***340***	481	***490***	693
45	64	***195***	276	***345***	488	***495***	700
50	71	***200***	283	***350***	495	***500***	707
55	78	***205***	290	***355***	502	***505***	714
60	85	***210***	297	***360***	509	***510***	721
65	92	***215***	304	***365***	516	***515***	728
70	99	***220***	311	***370***	523	***520***	735
75	106	***225***	318	***375***	530	***525***	742
80	113	***230***	325	***380***	537	***530***	750
85	120	***235***	332	***385***	544	***535***	757
90	127	***240***	339	***390***	552	***540***	764
95	134	***245***	346	***395***	559	***545***	771
100	141	***250***	354	***400***	566	***550***	778
105	148	***255***	361	***405***	573	***555***	785
110	156	***260***	368	***410***	580	***560***	792
115	163	***265***	375	***415***	587	***565***	799
120	170	***270***	382	***420***	594	***570***	806
125	177	***275***	389	***425***	601	***575***	813
130	184	***280***	396	***430***	608	***580***	820
135	191	***285***	403	***435***	615	***585***	827
140	198	***290***	410	***440***	622	***590***	834
145	205	***295***	417	***445***	629	***595***	841
150	212	***300***	424	***450***	636	***600***	849